Environmental Assessment: Johnson Space Center Building 24 CHP Expansion

NASA Johnson Space Center
Harris County, Texas

December, 2013

National Aeronautics and Space Administration
Johnson Space Center

2101 NASA Pkwy
Houston, TX 77058
(281) 483-0123

JSC-66689

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
NOTICE:

National Environmental Policy Act (NEPA); Construction of a Combined Heat and Power (CHP) Cogeneration Facility

AGENCY: NASA Johnson Space Center (JSC)

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: Pursuant to the 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); NASA is issuing this FONSI with respect to the construction and operation of a CHP facility at the JSC. The Proposed Action would include the addition of a CHP facility within an expansion of Building 24, the primary central steam generation plant on the JSC campus. The installation of the CHP facility will require a 9,240 square feet addition on the north end of the building, as well as ancillary equipment including a dedicated high pressure natural gas pipeline, a 12,000-gallon ammonia tank, and connectivity to existing infrastructure.

DATE: December 12, 2013

ADDRESS: The Final Environmental Assessment (EA) that serves as the basis for this FONSI may be viewed at the following locations:

- JSC Industry Assistance Office, Building 111, 2101 NASA Parkway, Houston, TX 77058 from 7:30 a.m. to 4:00 p.m.
- Clear Lake City – Harris County Freeman Branch Public Library, 16616 Diana Lane, Houston, TX 77062

A limited number of copies of the Final EA are available by contacting Mr. David Hickens, Chief, NASA-JSC Environmental Office at JSC, MC-JE, 2101 NASA Parkway, Houston, TX 77058 or by E-mail: david.hickens-1@nasa.gov

FOR FURTHER INFORMATION CONTACT:

Charles F. Webster at 281-483-2112 or by E-mail: charles.f.webster@nasa.gov

SUPPLEMENTAL INFORMATION: NASA has finalized the EA for the construction and operation of the CHP facility. The Final EA concludes that an accurate and appropriate analysis of the scope and level of associated environmental impacts has been completed. A summary of the findings is provided below.

Public Involvement

NASA solicited public and agency review and comment on the environmental impacts of the 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. Publishing the Draft EA on the JSC Environmental Office Web site; and
4. Consulting with Federal, state, and local agencies.

Appendix A includes a distribution list of contacts that received an announcement of the intent to prepare this EA, as well as all responses and comments. 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 input was received prior to the publication of this EA.

Purpose and Need for the Project

NASA – JSC is proposing to construct a CHP facility as an Energy Savings Performance Contract (ESPC) project to reduce energy use, increase energy efficiency, provide energy surety, and decrease green-house gas emissions. This action meets the requirements of the Energy Independence and Security Act, 2007, and Executive Orders 13423 and 13624.

Alternatives Considered

The EA addresses the construction and operation of a CHP facility, ancillary facilities, and a dedicated natural gas pipeline, and describes the potential impacts from the No Action Alternative, one Alternative Action (siting the CHP facility in a different portion of the JSC campus), and the Proposed Action.

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 Executive Orders 13423 and 13624. JSC would continue to utilize the existing steam generation system and rely on additional energy inputs from the local electrical grid. Annual purchased energy usage and cost would continue at current levels. Therefore, the no action alternative would result in the following impacts when compared to the proposed action:

- 28.7 percent greater combined site and source energy usage (616 million BTU per year)
- Additional annual energy costs of approximately $4.2 million
- Lack of reduction in energy intensity reduction metrics from 226,934 BTU/GSF to 102,317 BTU/GSF.
- Additional combined site and source CO_2 emissions of 29,122 metric tons

An alternative to constructing the proposed CHP system at Building 24 is the construction of the CHP facility at another location within the JSC campus. The most logical alternative site was identified adjacent to the Building 221 electric substation at JSC. If the CHP facility were located at this site, the construction would require a completely new building and considerable

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 would be substantially more expensive than the Proposed Action, as the 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 and steam plant.

SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS: A full comparative discussion of environmental effects of all Alternatives is contained in the Final EA. Potential environmental impacts resulting from NASA's Proposed Action/Preferred Alternative are summarized below:

Geology and Soil Resources: Disturbed soils could be removed during construction by wind or precipitation during storm events. Any losses would be expected to be minor as NASA would implement strict erosion and sediment controls. Inadvertent spills or leaks from construction equipment could adversely affect soils. NASA would require its contractors to implement Best Management Practices (BMPs) for equipment fueling, storage and maintenance. Implementation of spill prevention and control measures would also be required prior to starting work. Due to the small construction area and minimal ground disturbance, the effects on soil resources would be expected to be highly localized and have negligible impacts on the environment. There are no anticipated impacts to geological resources.

Water: There is potential for minor impacts from storm water runoff entering drainage ways during land-disturbing construction activities. To mitigate potential effects, construction would comply with JSCs established Storm Water Pollution Prevention Plan (SWPPP). In addition, a site-specific Sedimentation and Control Plan for the lay-down yard and any ground disturbance activities would be implemented. During operation of the facility, NASA would ensure that the facility complies with BMPs established in the JSC SWPPP to ensure that post-construction runoff quality and quantities meet state and Federal standards. The proposed facility would not be located within a wetland or floodplain and would not be expected to impact these sensitive resources.

Biological Resources: The developed, landscaped area that would be converted to the proposed project provides marginal plant and 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, including migratory birds protected by the Migratory Bird Treaty Act. It is anticipated that most wildlife species would be able to avoid the construction disturbance associated with the proposed project by relocation to adjacent minimally disturbed areas. In addition, JSC carefully protects all nesting areas on the campus, including in construction areas. Should a nest be discovered in the immediate CHP construction area, BMPs could require up to temporary cessation of construction until fledging occurs. Impacts to wildlife and migratory species from construction activities are anticipated to be negligible to minor.

In 2005, JSC licensed 1.7 acres of land to the Houston Zoo for the siting of their Attwater's prairie chicken (APC) captive breeding program. The captive breeding facility is located

approximately 3,900 feet (0.73 mile) from the proposed project location. APCs are held captive within the facility and their eggs are moved to the zoo before hatching. The chicks are released to the wild and the species does not occur within the project area. The small scale of the project and distance from the APC breeding facility would result in no effect to the Attwater's prairie chicken. The proposed action would likewise have no impacts on designated preferred habitat or preferred threatened and endangered species.

Air Quality: The proposed action does not result in a net increase of emissions above the major modification thresholds as outlined in 30 TAC §116.150 for Nonattainment New Source Review for areas designated as in severe non-attainment for ozone. Therefore, the proposed action complies with the general conformity requirements by complying with the State Implementation Plan approved program. Implementation of the proposed project would have both short-term and long-term negligible impacts to air quality. Short-term adverse effects would result from dust and air emissions during construction. Minimization of dust emissions during construction; however, would be achieved through the use of best management practices. Replacing the existing utility plant at JSC with a more efficient CHP facility that reduces criteria pollutant emissions and results in a net decrease in combined site and source GHG emissions would result in a long term beneficial effect on air quality.

Noise: Construction activities could temporarily increase noise levels. 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. Operational noise levels outside of the proposed facility would be below the existing limits established in JSC's municipal noise permits. Therefore, noise generated from the proposed action would be expected to have negligible impacts.

Land Use: Construction of the CHP facility would be consistent with existing land use and the JSC Master Plan; therefore no adverse impacts would occur.

Cultural and Historic Resources: Some JSC historic resources are located within the visual Area of Potential Effects (APE) of the proposed project. The proposed project location; however, is not visible from either of JSC's National Historic Landmarks, the Mission Control Center (Building 30) or the Space Environment Simulation Lab (Building 32). Therefore, no visual impacts to the National Historic Landmarks or NRHP-eligible properties would be anticipated. No recorded archaeological sites are located within the Center. Because the project footprint would require minimal ground disturbance and the majority of the JSC was graded and leveled during construction in 1961, no sub-surface archeological resources would be anticipated to be impacted. Therefore, overall impacts to historic resources would be expected to be minimal.

Socioeconomics and Environmental Justice: Review of local community demographics indicate that disproportionately high or adverse impacts to low-income or minority populations are not anticipated. The proposed action is not expected to trigger changes in the socioeconomics of the community surrounding JSC.

Transportation: Temporary minor increases in traffic due to construction would be anticipated as a result of the proposed action. The impacts of increases in traffic would be mitigated through coordination and the use of traffic management BMPs. Impacts to traffic would be temporary and are unlikely to significantly impact on traffic outside of JSC.

Hazardous Materials and Waste Management: No hazardous materials would be anticipated to be generated by the construction of the CHP facility. Small amounts of construction debris would be generated and either be recycled or properly disposed. Overall impact of construction waste would be negligible.

Cumulative Impacts: Based on ongoing and future projects as included in the JSC Master Plan, construction of the CHP facility could contribute to cumulative adverse effects on traffic and noise levels within JSC during construction, but the scale and short-term nature of these impacts would have no more than a negligible cumulative effect. No cumulative impacts would be expected during facility operation; therefore, long-term cumulative impacts to environmental resources would not be expected to be significant.

Conclusion: NASA has identified no other potential environmental impacts resulting from the Proposed Action. Therefore, based on the Final EA for the construction and operation of the CHP facility and ancillary equipment, 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, an environmental impact statement is not required.

Melanie Sandle 3-26-14

for Ellen Ochoa, Director — Date
Johnson Space Center

Environmental Assessment: Johnson Space Center Building 24 CHP Expansion

2101 NASA Pkwy, Houston, Harris County, Texas

Lead Agency:	NASA, Johnson Space Center
Proposed Action:	Construction of a Combined Heat and Power (CHP) facility at the NASA Johnson Space Center consisting of two 6.3 megawatt (MW) combustion gas turbines and associated ancillary equipment. A dedicated high pressure (300 psig) natural gas line (6,000 ft.) would be installed within an existing utility Right of Way (ROW) and connected to the new expansion, currently envisioned to be north of Building 24. In addition to the construction of the new natural gas pipeline, approximately 9,700 feet of existing pipeline would be upgraded to support the proposed facility.
For Further Information:	David Hickens, Environmental Office Lead, david.hickens-1@nasa.gov, (281) 483 – 3120
Date:	December 12, 2013

Abstract:

This Environmental Assessment (EA) examines the proposed construction of a CHP facility in an expansion on the north side of Building 24 at the NASA Johnson Space Center. In addition to the no-action alternative, one alternative site was examined 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
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWA	Clean Water Act
dB	Decibels
dBA	Adjusted Decibels
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
SEC	Sedimentation and Erosion Control
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) proposes to construct a combined heat and power system (CHP), also known as cogeneration, for the Johnson Space Center (JSC). CHP systems are an extremely efficient method to simultaneously generate electricity and useful heat. The efficiency of CHP is approximately twice that associated with normal utility power generation. The heat rejected by a traditional utility electric generating plant to an adjacent body of water or cooling towers is instead effectively utilized in a cogeneration application.

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 13.7 MW of onsite power generation, allowing JSC to meet all energy reduction goals through 2020.

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, 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 as an expansion of the existing Building 24 Central Plant. The CHP system would satisfy the majority of JSC's electric demand ranging from 15MW in the winter to 28MW in the summer while maintaining a minimum import of 2 MW from the electric grid at all times. The CHP system's recoverable thermal energy produces nearly 60,000 pounds per hour of 400 psig, 600°F superheated steam in the heat recovery steam generator (HRSG). 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 project is being developed utilizing an energy savings performance contract (ESPC) methodology. There is no JSC capital requirement with the proposed implementation. Significant benefits of this CHP project to NASA include:

- ***Increased Energy Surety***……The proposed system would provide approximately 13.7 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 13423. By implementing the project, JSC would reduce their energy intensity from FY 2012 values of 226,934 BTU/GSF down to 102,317 BTU/GSF and meet all energy reduction goals through 2020.

- ***Carbon Footprint Reductions***…..The NASA JSC carbon footprint would be reduced by 29,122 metric tons of CO_2 equivalent. This reduction is approximately equivalent to eliminating 3,700 automobiles or reforesting 4,400 acres.

- ***Presidential Executive Order***…..This project is in full compliance with and supports Executive Order 13624 enacted by President Obama, August 31, 2012 encouraging the use of cogeneration.

The CHP would consist of two nominal 6.3 MW combustion turbines with heat recovery steam generation. The CHP system would also deploy a backpressure turbine at 1.1 MW which generates electricity and reduces high pressure superheated steam down to medium pressure for distribution throughout the Center. 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. Additionally, a 12,000 gallon tank containing 19% aqueous ammonia would be located northwest of the proposed CHP facility and immediately north of the existing cooling towers. The tank would be connected to the northwest portion of the expansion via approximately 100 feet of pipeline.

The JSC campus consumes both chilled water and steam throughout the year, thus satisfying 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 and potentially escalating electricity costs. All electricity and steam generated by the CHP system would be utilized by JSC.

Installation and operation of the CHP system and ancillary equipment would not have significant impacts on geology and soils, biological resources, land use, cultural and historic resources, socioeconomics and environmental justice, transportation, and hazardous materials and waste management.

The CHP system would be operated in an area that is classified under the Clean Air Act as nonattainment for the 8-hour ozone criterion. The proposed action would not result in a net increase of emissions above the major modification thresholds, as outlined in 30 TAC §116.150 for Nonattainment New Source Review, for areas designated as severe nonattainment for ozone. Therefore, the proposed action complies with the general conformity requirements by complying with the State Implementation Plan approved program. NASA concludes that operation of the system would conform to the State's implementation plan and would be in compliance with federal and Texas air quality regulations. Operation of the new CHP system would reduce JSC's consumption of electricity from the regional grid and would be more energy efficient than current operations. Although site emissions would increase, this increase is more than offset by the reduction in source emissions. This system would reduce the NASA JSC carbon footprint by 29,122 metric tons of CO_2 equivalent on an annual basis. Long-term negligible to minor beneficial effects on GHG emissions would result from converting the existing utility plant at JSC to a more efficient steam and power generation system that results in a net reduction in combined site and source emissions.

Construction and operation of the CHP facility would have negligible impacts to water quality. There is the potential for minor impacts from storm water runoff entering drainage ways during land-disturbing 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 Control Plan 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 BMPs established in the JSC SWPPP so that post-construction runoff quality and quantities meet state and federal standards. The proposed facility would not be located within a wetland or floodplain and would not be expected to have any impacts on these sensitive resources. Therefore, impacts to water resources are expected to be negligible.

Construction activities would generate temporary increases in noise levels. 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. Operational noise levels outside of the proposed facility would be below the existing limits established through JSC's municipal noise permits. Therefore, noise generated from the proposed action would be expected to have negligible impacts.

During the Preliminary Assessment for this ESPC project, the following energy conservation measures (ECMs) were proposed by Chevron Energy Solutions:

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 the Investment Grade Audit (IGA) and Final Proposal for 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.

The alternative to constructing the proposed CHP system at Building 24 is the construction of the CHP facility at another location within the JSC campus. The most logical alternative site was identified adjacent to the Building 221 electric substation at JSC. If the CHP facility were located at this site, 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 would be substantially more expensive than the Proposed Action, as the 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 and steam plant. Although considered, this alternative was not carried forward in this assessment due to the reasons described above.

Under the No-Action Alternative, the CHP facility and ancillary equipment would not be constructed at JSC. Thus, under the No-Action alternative, JSC would continue to utilize the existing steam generation system and rely on additional energy inputs from the local electrical grid. Annual energy usage would continue at or near current levels.

The high potential for the Proposed Action was initially identified in a campus energy optimization study developed by Chevron Energy Solutions for JSC which concluded that NASA JSC was an excellent candidate for implementation of a CHP system. Since the initial study, a Preliminary Assessment was developed that analyzed and optimized various prime mover technologies as

well as capacity increments along with the aforementioned ECMs, two of which were selected by NASA for inclusion in the Final Proposal.

Significant benefits to NASA resulting from the Proposed Action include:

- Increased Energy Surety - The proposed system will provide approximately 13.7 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 - By implementing the project, JSC will reduce their energy intensity from 226,934 BTU/GSF down to 102,317 BTU/GSF (54.9% reduction) and meet all energy reduction goals through 2020.
- Carbon Footprint Reductions - The NASA JSC combined source carbon footprint will be reduced by 29,122 metric tons of CO_2 equivalent annually. This equates to a 30% reduction from the baseline (no action) conditions.
- Legislative compliance - This project supports compliance with the NECPA, the EPAct of 2005, the EISA, EO 13423, EO 13514, and EO 13624.

NASA – JSC is proposing to construct a CHP facility as an ESPC project to achieve the goals outlined above. JSC has selected Chevron Energy Solutions to assess the feasibility of the proposed action and construct the CHP facility.

The proposed CHP facility would reduce combined site and source energy use at JSC by 28.7 percent and save up to 4.2 million dollars annually. The Proposed Action would reduce energy intensity by 54.9 percent. This project would also reduce site and source CO_2 emissions attributable to JSC by approximately 30 percent. 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.

On the basis of the evaluations in this environmental assessment, NASA determined that the Proposed Action, construction and operation of a CHP facility at the central utility plant on the JSC campus would have no significant impact on the human environment.

1.0 INTRODUCTION

NASA JSC proposes to construct a CHP plant. As part of the decision-making process, NASA, in cooperation with Chevron Energy Solutions, is conducting an analysis to determine the potential environmental impacts of a CHP facility. NASA is the lead federal agency for the development of this Environmental Assessment (EA), in accordance with 40 Code of Federal Regulations (CFR) § 1501.3.

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 a heat recovery steam generator (HRSG) that produces steam.

The proposed CHP facility (hereafter also called the proposed project) will involve the construction of two combustion turbines and associated ancillary equipment. The existing Building 24 would need to be expanded in order to house the CHP system. The CHP facility would also require a dedicated high pressure (300 pounds per square inch, gauge (psig)) natural gas line to be installed within an existing utility right-of-way (ROW) and extended to the proposed CHP.

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.

This central utility plant generates all the steam and the majority of chilled water for the campus. The steam and chilled water are furnished primarily for building heating, air conditioning, and ventilation reheating for humidity control.

1.1 PROJECT LOCATION

JSC is a NASA installation in Houston, Harris County, Texas. It is located on 650 hectares (1,620 acres), approximately 40 kilometers (25 miles) southeast of downtown Houston and three kilometers (two miles) northeast of Webster. JSC is bounded by Space Center Boulevard to the north and east, NASA Parkway to the southeast, Saturn Lane to the southwest, and a canal to the west. The JSC site is fairly flat, with elevations ranging from three to six meters (ten to twenty feet) above sea level. (Figure 1)

JSC is connected to the local roadway system by gates to NASA Parkway to the south, Space Center Boulevard to the north and east, and Saturn Lane to the west. JSC adjoins homes and offices in the Clear Lake City development to the north and west. Adjacent properties to the south include shops, offices and homes in the City of Nassau Bay. Armand Bayou Nature Center is located northeast of JSC. A residential area and a historical property known as the West Mansion are located on adjacent property east of JSC. The West Mansion formerly housed the Lunar and Planetary Institute of Rice University. Mud Lake and Clear Lake, tributaries of Galveston Bay, are located east of JSC. A canal created before JSC was built in 1961 traverses the south side of JSC. The canal previously carried cooling water from Houston Lighting & Power Company's Webster Power Station (now decommissioned and demolished), located two kilometers (one mile) to the south, and flows into Clear Lake.

1.2 PURPOSE AND NEED

The purpose and need of the Proposed Action is to meet the goals and requirements of federal laws and EOs by creating a system for producing heat and electricity that would reduce energy cost, usage, and intensity while increasing energy surety and generating environmental benefits.

1.2.1 The National Energy Conservation Policy Act

The National Energy Conservation Policy Act of 1978 (NECPA) (42 USC. § 8251 et seq.) serves as the underlying authority for Federal energy management goals and requirements. The NECPA is regularly updated and amended and provides a large and diverse array of measures intended to promote energy conservation in buildings, industry, and transportation. Subsequent amendments require federal buildings to reduce energy consumption per square foot relative to baseline conditions, energy metering, energy and water evaluations, implementation of efficiency measures, and compliance tracking, and direct the DOE to coordinate conservation activities through the Interagency Energy Management Task Force. The NECPA also clearly states that large capital investments in an existing building that involve replacement of installed equipment (such as heating and cooling systems) "…employs the most energy efficient designs, systems, equipment, and controls that are life-cycle cost effective".

1.2.2 The Energy Policy Act of 2005

The Energy Policy Act of 2005 (EPAct of 2005) (42 USC §13201 et seq.) amended the NECPA and addresses a variety of federal energy policies. It includes provisions related to: energy efficiency, renewable energy, oil and gas, coal, Tribal energy, nuclear matters and security, vehicles and motor fuels, including ethanol, hydrogen, electricity, energy tax incentives, hydropower and geothermal energy, and climate change technology. The EPAct of 2005 established a number of energy management goals and management

requirements for federal facilities and fleets. The most applicable sections of the EPAct to the Proposed Action are Sections 102-105. Section 102 of the EPAct of 2005 re-established the statutory energy reduction requirement for Federal buildings, stating that consumption per gross square foot must be reduced by 20 percent by 2015 relative to a 2003 baseline. Section 103 established a requirement for metering all federal buildings for accountability. Section 104 of the EPAct requires that each agency consider criteria for energy efficiency that are consistent with Energy Star products and for rating FEMP designated products in the specifications for all procurements involving energy consuming products and systems. Finally, Section 105 extends the authority for federal agencies to enter into Energy Savings Performance Contracts (ESPC) for energy and water conservation. The EPAct also establishes federal building energy efficiency performance standards and renewable energy goals for the total amount of energy consumed by the federal government.

1.2.3 The Energy Independence and Security Act of 2007

The Energy Independence and Security Act of 2007 (EISA) (Pub.L. 110-140) was enacted "to move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government, and for other purposes." The EISA adopts the energy intensity reduction goals of Executive Order 13423 (described below) beginning in FY 2008 with a 9 percent reduction and increasing to a 30 percent reduction in FY 2015.

1.2.4 EO 13423 – Strengthening Federal Environmental, Energy, and Transportation Management

EO 13423 was signed on January 26, 2007 (72 Federal Register 3919), to consolidate and strengthen five EOs and two memoranda of understanding and establish new and updated goals, practices, and reporting requirements for environmental, energy, and transportation performance and accountability. This EO requires Federal agencies to lead by example in advancing the nation's energy security and environmental performance by achieving the following goals:

- Energy Efficiency: Reduce energy intensity 30 percent by 2015, compared to an FY 2003 baseline.
- Greenhouse Gases: Reduce greenhouse gas emissions through reduction of energy intensity 30 percent by 2015, compared to an FY 2003 baseline.
- Renewable Power: At least 50 percent of current renewable energy purchases must come from new renewable sources (in service after January 1, 1999).
- Building Performance: Construct or renovate buildings in accordance with sustainability strategies, including resource conservation, reduction, and use; siting; and indoor environmental quality.

- Water Conservation: Reduce water consumption 16 percent by 2015, compared to an FY 2007 baseline.
- Vehicles: Increase purchase of alternative fuel, hybrid, and plug-in hybrid vehicles when commercially available.
- Petroleum Conservation: Reduce petroleum consumption in fleet vehicles by 2 percent annually through 2015, compared to an FY 2005 baseline.
- Alternative Fuel: Increase use of alternative fuels by at least 10 percent annually, compared to an FY 2005 baseline.
- Pollution Prevention: Reduce use of chemicals and toxic materials and purchase lower risk chemicals and toxic materials.
- Procurement: Expand purchases of environmentally sound goods and services, including bio-based products.
- Electronics Management: Annually, 95 percent of electronic products purchased must meet Electronic Product Environmental Assessment Tool standards where applicable; enable Energy Star® features on 100 percent of computers and monitors; and reuse, donate, sell, or recycle 100 percent of electronic products using environmentally sound management practices.

1.2.5 EO 13514 – Federal Leadership in Environmental, Energy, and Economic Performance

This EO was ordered by President Obama on October 5, 2009 (74 Federal Register 52117) and expanded upon the energy reduction and environmental performance requirements outlined in EO 13423 by adding the following measures to be implemented by federal agencies:

- Increase accountability, transparency, and reporting requirements, such as preparation of scorecards evaluating federal agency performance that are published on a publically available website;
- Develop a Strategic Sustainability Performance Plan establishing goals and targets including GHG reduction targets;
- Establish and report a 2020 percentage reduction target of agency wide Scope 1, Scope 2, and Scope 3 GHG emissions relative to 2008 baselines;
- Enhance efforts towards sustainable buildings and communities through design, construction, operation, management, maintenance, deconstruction, and regional and local integrated planning;
- Improve water efficiency by reducing consumption intensity and industrial, landscaping, and/or agricultural consumption by 2% annually or 26% by 2020 relative to 2007 and 2010 baselines;
- Ensure that 95% of new electronic products and services are energy efficient, water efficient, bio-based, environmentally preferable, etc.;

- Consider fleet and transportation management during GHG inventory and mitigation processes; and
- Reduce waste and pollution by minimizing generation, decreasing chemical use, diversion of non-hazardous solid waste, reduction of paper use, and diversion of compostable and organic material from the waste stream.

1.2.6 EO 13624 – Accelerating Investment in Industrial Energy Efficiency

Finally, EO 13624 was ordered by President Obama on August 30, 2012 to facilitate investments in energy efficiency at industrial facilities. Specifically, the order states that federal agencies such as the Departments of Energy, Commerce, and Agriculture and the Environmental Protection Agency shall:

a) coordinate and strongly encourage efforts to achieve a national goal of deploying 40 gigawatts of new, cost-effective industrial CHP in the United States by the end of 2020;

b) convene stakeholders, through a series of public workshops, to develop and encourage the use of best practice State policies and investment models that address the multiple barriers to investment in industrial energy efficiency and CHP;

c) utilize their respective relevant authorities and resources to encourage investment in industrial energy efficiency and CHP; and

d) support and encourage efforts to accelerate investment in industrial energy efficiency and CHP.

Although not specifically tasked in this EO, NASA is facilitating DOE and EPA compliance with this EO by working with these agencies to implement the Proposed Action.

1.2.7 Applicable Benefits from the Proposed Action

The high potential for this project was initially identified in a campus energy optimization study developed by Chevron Energy Solutions for JSC. Since the initial study, a Preliminary Assessment was developed that analyzed and optimized various prime mover technologies as well as capacity increments.

Significant benefits to NASA resulting from the Proposed Action include:

- Increased Energy Surety - The proposed system would provide approximately 13.7 MW of onsite power generation that could 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 13423. By implementing the project, JSC would reduce their FY 2012 energy intensity from 226,934 BTU/GSF down to 102,317 BTU/GSF (54.9 percent reduction) and meet all energy reduction goals through 2020. While the prescribed energy reductions are on a Federal Agency basis, this

project would significantly contribute to meeting NASA agency-wide requirements.

- Carbon Footprint Reductions - The NASA JSC carbon footprint would be reduced by 29,122 metric tons of CO_2 equivalent annually. This equates to a 30 percent reduction from baseline (no action) conditions.
- Legislative compliance - This project supports compliance with the NECPA, the EPAct of 2005, the EISA, EO 13423, EO 13514, and EO 13624.

NASA – JSC proposes to construct a CHP facility as an ESPC project to achieve the goals outlined above. An ESPC is a partnership between a federal agency and an energy service company (ESCO). The ESCO conducts a comprehensive energy audit of federal facilities and identifies improvements to save energy. In consultation with the federal agency, the ESCO designs and constructs a project that meets the agency's needs and arranges the necessary funding. The ESCO guarantees that the improvements will generate energy cost savings to pay for the project over the term of the contract (up to 25 years). After the contract ends, all additional cost savings accrue to the agency. JSC has selected Chevron Energy Solutions to assess the feasibility of the proposed action and construct the CHP facility.

1.3 ORGANIZATION AND OBJECTIVES OF THIS EA

This chapter explains the purpose and need for the Proposed Action (Section 1.2), the requirements of the National Environmental Policy Act (NEPA) and other applicable regulations (Section 1.3), and the public involvement process followed during development of the EA (Section 1.4). 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.

1.3.1 National Environmental Policy Act

NEPA (42 United States Code [U.S.C.] 4321 et seq.), is a federal statute requiring the identification and analysis of potential environmental impacts associated with proposed federal actions before those actions are taken. This requirement also applies to decisions about whether to provide different types of Federal financial assistance to recipients. The intent of NEPA is to help federal agency officials make well-informed decisions based on an understanding of the potential environmental consequences and take actions to protect, restore, or enhance the environment. NEPA established the Council on Environmental Quality (CEQ) that was charged with the development of implementing regulations and ensuring Federal agency compliance with NEPA. CEQ regulations mandate that all federal agencies use a prescribed, structured approach to environmental impact analysis. This approach also requires federal agencies to use an interdisciplinary and systematic approach in the decision-making process.

This EA is being conducted in accordance with NEPA; CEQ implementing regulations; and the NEPA implementing regulations of NASA. Federal agencies must evaluate the purpose and need, reasonable alternatives, and the potential environmental impacts of any Proposed Action that could have a significant impact on human health and the environment, including decisions on whether to provide financial assistance to government agencies and private entities. In compliance with these regulations, this EA:

- Examines the potential direct and indirect environmental impacts of the Proposed Action and the No Action Alternative;
- Identifies unavoidable adverse environmental impacts of the Proposed Action;
- Identifies potential environmental benefits of the Proposed Action;
- Discusses the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity;
- Characterizes irreversible and irretrievable commitments of resources that would be involved if NASA and its cooperating agencies approve the Proposed Action;
- Analyzes past, present, and reasonably foreseeable actions to evaluate potential cumulative impacts.

Federal agencies must meet the requirements of NEPA before making a final decision to proceed with a proposed federal action that could cause significant impacts to human health or the environment. This EA provides NASA, other agencies, and other decision-makers the information necessary to make an informed decision about the construction and operation of the proposed project. For purposes of comparison, this EA also evaluates the impacts that could occur if the federal agencies do not implement the Proposed Action (the No Action Alternative), under which it is assumed that JSC would not proceed with the proposed project.

1.3.2 NASA Procedural Requirements and Other Environmental Regulations

The NEPA planning and decision-making process involves a study of other relevant environmental statutes and regulations. The NEPA process; however, does not replace procedural or substantive requirements of other environmental statutes and regulations. It addresses them collectively in the form of an EA or Environmental Impact Statement (EIS), which enables the decision-maker to have a comprehensive view of major environmental issues and requirements associated with the Proposed Action and its alternatives. According to CEQ regulations, the requirements of NEPA must be integrated "with other planning and environmental review procedures required by law or by agency so that all such procedures run concurrently rather than consecutively" (40 CFR Part 1500.2(c)).

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 of the public scoping process are also discussed. This NPR 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 addition to complying with NEPA, CEQ regulations (40 CFR Parts 1500-1508), and NPR 8580.1A, this EA also addresses other applicable laws and regulations, including but not limited to the following:

National Historic Preservation Act (NHPA)
The Noise Control Act of 1972, as amended
Environmental Justice ([EO] 12898)
Clean Air Act (CAA)
Clean Water Act (CWA)
Migratory Bird Treaty Act (MBTA)
Endangered Species Act (ESA)
Pollution Prevention Act (PPA)
Resource Conservation and Recovery Act (RCRA)
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

1.3.3 Scope of the Analysis

The EA examines potential effects of funding construction of the CHP facility, the Proposed Action of constructing and operating the CHP facility, and the No Action Alternative on eleven resource areas: geology and soil resources, water resources, biological resources, air quality, noise, land use, cultural and historic resources, hazardous materials and waste, and human health and safety. These resource areas were identified as being potentially affected by the proposed project or its alternatives, and include applicable critical elements of the human environment whose review is mandated by EO, regulation, or policy. The following resource areas were considered but not carried forward for further analysis due to the lack of potential effects: socioeconomics and environmental justice, transportation.

1.4 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 this EA. 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.

1.4.1 *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 its own electricity would reduce the necessity for the campus to purchase electricity from public utilities, which would result in decreased electrical demand within the area.

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

1. Publishing notices of availability of Draft EA and FONSI in local newspapers;

2. Making the Draft EA and FONSI available for review at local public libraries;

3. Publishing the Draft EA and FONSI on the JSC Environmental Office Web site; and

4. Consulting with federal, state, and local agencies.

Comments received will be considered in the Final EA.

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

1.4.2 *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 this EA. Appendix A includes a distribution list of contacts that received an announcement of the intent to prepare this 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 input was received prior to the publication of this Draft EA.

A Notice of Availability (NOI) of this Draft EA was published in the *Bay Area Citizen* on December 12, 2013. All documented agency consultations or comments regarding the proposed project will be included in the final version of this EA.

2.0 PROPOSED ACTION AND ALTERNATIVES

This section describes NASA'S Proposed Action, Alternative Actions Considered but not Carried Forward, and the No Action Alternative.

2.1 PROPOSED ACTION

NASA proposes to construct a CHP facility at the JSC. The proposed action supports the mandates detailed in EPAct 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 would 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 6.3 megawatt (MW) combustion turbines with heat recovery steam generators (HRSG). The CHP system would also deploy a backpressure turbine at 1.1 MW which generates electricity and reduces high pressure (400 psig), superheated (600 °F) steam down to medium pressure (140 psig) for distribution throughout the Center. The JSC campus consumes both chilled water and steam throughout the year, thus satisfying 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 in a new addition to the existing Building 24 Central Plant.

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, Building 24 is the most logical location for the CHP facility. The installation of the CHP and ancillary equipment would require a small addition on the north end of the building. 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. Additionally, a 12,000 gallon tank containing 19% aqueous ammonia would be located northwest of the proposed CHP facility and immediately north of the existing cooling towers. It would be connected to the northwest portion of

the expansion via approximately 100 feet of pipeline. Aqueous ammonia would be utilized for selective catalytic reduction to convert NOx to NO_2 and water and reduce overall NOx emissions.

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 source energy costs and enable JSC to meet Federal energy efficiency goals.

The proposed CHP would reduce combined site and source energy use at JSC by 28.7 percent and save up to 4.2 million dollars annually. The Proposed Action would reduce energy intensity by 54.9 percent. This project would also reduce site and source CO_2 emissions attributable to JSC by approximately 30 percent. 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 Facility and Distribution System

To develop the Building 24 site for a robust CHP expansion that could withstand hurricane force winds, a single-story expansion with a mezzanine level building is planned with all critical electrical generation equipment located on the first floor at an elevation of 22 feet above mean sea level (AMSL).

The layout of the structural steel would be suitable for static and dynamic loading. The CHP expansion would exceed the width of the existing structure along the east-west axis, and have a footprint of approximately 9,240 square feet. The dimensions for the new expansion would be approximately 75 feet, 6.5 inches x 120 feet, 10 inches (Figures 2 and 3).

The addition north of the existing building at the first level would contain the two combustion turbines and the new backpressure steam turbine. The two (2) 6.3 MW combustion turbines would be placed at the center of the addition, allowing for heat recovery steam generators on the west side of the addition. The backpressure steam turbine and electrical equipment would be located on the east side of the addition.

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 natural gas savings of approximately two (2) percent. Final routing of the proposed natural gas line across JSC would be developed in the future in conjunction with CenterPoint energy. A preliminary layout is provided in Figures 1 and 2.

2.2.2 Operation of the CHP facility

Once operational, the proposed CHP facility would produce 13.7 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 HRSG 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 a previously undeveloped area. It 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 would be substantially more expensive than the Proposed Action, as the 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. 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 electric 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:

TABLE 2.4-1: Energy Impacts of No Action Alternative vs. Proposed Action

Energy Metric	Impact of No Action Alternative	Impact of Proposed Action
Combined site and source energy usage	No significant change	616 million BTU reduction (28.7 percent)
Annual purchased energy costs	No significant change	$4.2 million reduction
Energy intensity	No significant change	124,617 BTU/GSF reduction (54.9 percent)
Combined site and source CO2 emissions1	No significant change	33,247 metric ton reduction (30.75 percent)

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

All potentially relevant resource areas were initially considered for analysis in this EA. In compliance with NEPA and CEQ implementing regulations, this EA 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, 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.

[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 reductions referred to within this document. Please refer to Section 3.5.2 of this document for a detailed emissions analysis.

3.1 RESOURCE AREAS DISMISSED FROM FURTHER ANALYSIS

Groundwater

Two important fresh water aquifers, the Chicot and the Evangeline, are located under the Houston area. Both aquifers are comprised of discontinuous sand, silt and clay. In southern and eastern parts of the region the aquifers are artesian; that is, they are under pressure and tend to rise in wells. At JSC, the base of the Chicot aquifer is between 180 and 210 meters (600 and 700 feet) below the surface, and the base of the Evangeline aquifer is between 790 and 910 meters (2,600 and 3,000 feet) below the surface (USGS, 2008).

As part of the proposed project, no water would be removed from the water table, no pollutants would be released to the aquifers and no interaction with groundwater resources is anticipated. Therefore, no impacts to groundwater are anticipated and this resource was removed from further analysis.

3.2 GEOLOGY AND SOIL RESOURCES

3.2.1 *Affected Environment*

JSC was built on a coastal plain of deep-river silt deposits known as the Beaumont formation. During warmer periods of the Pleistocene, vast amounts of mud, sand, and clay were carried by rivers and deposited onto a broad plain that slopes gently toward the Gulf of Mexico. This plain is today's Gulf Coast and adjacent Continental Shelf of the Gulf of Mexico.

The coastal plain is latticed by non-tectonic faults caused by earth movements. One hundred and thirty faults (active and inactive) extend over 300 kilometers (200 miles) in Harris County; however, none of these faults cross JSC. The faults damage pavement and buildings in urban areas. Underlying soils are mostly plastic clays and shales that readily convey strains to the surface. Ground movement at faults is gradual rather than episodic as with earthquakes. Until the mid-1980's, groundwater was the region's main source of potable water, and its withdrawal from underground aquifers caused widespread subsidence in the Houston area. The construction of the Southeast Water Purification Plant ended this reliance on groundwater (Elsbury et al, 1980).

JSC is located on a nearly level plain of clayey and loamy prairie soils, classified as Lake Charles clay, Bernard clay loam, Midland silty clay loam, and Beaumont clay. These soil series drain poorly and allow only a small amount of rainwater to permeate to the groundwater. Without modification, these soils are poor building foundations because they shrink when dry and swell when wet (USDA, 1976).

Soils have been sampled around JSC for various projects and the soil map is generally accurate. However, some of the samples from areas that were mapped

as Lake Charles or Bernard soils look more like League clay, a recently described soil series in Jefferson County, Texas. Soils present at JSC include some characteristic of prime farmland, but urbanization and property values preclude this designation. The entire Center was graded in 1961 and fill dirt was added to the soil profile in some areas (ERT, 2008).

3.2.2 Environmental Consequences of the Proposed Project

Protection of unique geological features, minimization of soil erosion, and the siting of facilities in relation to potential geologic hazards are considered when evaluating potential effects of a proposed project on geology and soil resources. Generally, adverse effects can be avoided or minimized if proper erosion-control measures and BMPs are incorporated into project development. A proposed project could have a significant effect with respect to geology and soil resources if any of the following were to occur: 1) alteration of the lithology, stratigraphy, and geological structure that control groundwater quality, distribution of aquifers and confining beds, and groundwater availability and 2) changes to the soil composition, structure, or function within the environment.

The proposed construction of the CHP facility and ancillary facilities would disturb approximately ¼ of an acre of land. The area immediately north of Building 24 has already been graded and sodded, but would be cleared and re-graded as needed. BMPs would be used throughout construction to limit potential impacts to the geological and natural environment. The CHP facility would be constructed on a concrete slab with a 9,240 square foot footprint. 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 ft x 5 ft) 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.

Standard construction equipment would be used to prepare the site. As with almost any construction project involving the use of heavy equipment, there would be some risk of an accidental fuel or chemical spill, with potential contamination of soils. Fuel products (petroleum, oils, and lubricants) would be needed to operate and fuel construction equipment. To reduce the potential for soil contamination, fuels would be stored and maintained in a designated equipment staging area. An emergency spill kit containing absorption pads, absorbent material, a shovel or rake, and other cleanup items would be readily available on site in the event of an accidental spill. Oils or other hazardous materials stored onsite would have secondary containment equal to or greater than 110% of the total volume of the largest container. Fuel transfers would follow all JSC-required procedures and BMPs. The potential for an accidental chemical or fuel spill to occur and result in adverse impacts on soils would be negligible.

The use of heavy construction equipment would also physically disturb underlying soils. Heavy equipment results in soil compaction, reducing the porosity and conductivity of the soil. Such compaction may slightly increase the amount of surface runoff in the immediate area. Most of the construction equipment would travel on and be stored on a paved parking area directly adjacent to the proposed project. No ground disturbance outside the footprint of the proposed project is anticipated.

Because the overall area to be impacted by construction is very small, the effects on soil resources are expected to be highly localized and have negligible impacts. Construction 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

JSC is located in the West Galveston Bay Watershed (HUC 12040204) (EPA, 2013c). JSC is proximate to tidal creeks and estuarine water bodies. Clear Lake is at the southeast corner; Mud Lake and Armand Bayou are northeast; Cow Bayou is southwest; and Horsepen Bayou is north of JSC. Horsepen Bayou flows east to its confluence with Armand Bayou (previously Middle Bayou). Armand Bayou and its tributaries drain about 164.5 square kilometers (63.5 square miles) of southeast Harris County (ABNC, 2002). Armand Bayou flows into the northern end of Mud Lake, part of the Clear Lake estuary, which is connected to western Galveston Bay. Cow Bayou flows into Clear Creek, which drains to Clear Lake. Galveston Bay is recognized by the U.S. Environmental Protection Agency (EPA) as an estuary of national significance and was included in the National Estuary Program in 1989.

Several of the surface waters near JSC are both water quality limited and integrally connected with Galveston Bay. Therefore, JSC has established a Storm Water Management Plan (SWMP) which includes an education program and implementation of BMPs for discharges to the storm water system, including sedimentation and erosion control during construction and maintenance activities involving disturbance of soil (Lynx, 2007).

The hydrology of JSC and the surrounding areas is heavily modified. The low and very gently sloping topography in conjunction with very poorly drained soils would have historically resulted in standing water and ephemeral wetlands across the area. However, alteration of the topography into canals, levies, and ditches for rice farming has modified this hydrology. Additionally, the entire

site was graded in the early 1960's prior to construction which altered the flow of water into new and existing ditches. Three artificial ponds were added to the central mall area during construction. These pools do not have regular flow into a watershed (ERT, 2008). (Figure 5)

Floodplains and Wetlands

EO 11988, Floodplain Management, requires federal agencies to determine whether a proposed project would occur within a floodplain. The following descriptions of floodplains and wetlands, and analysis of potential impacts to those surface water features, address the requirements in 10 CFR 1022 for a floodplain and wetlands assessment. Floodplains are areas of low-level ground along rivers, stream channels, or coastal waters, which provide a broad area to inundate and store floodwaters temporarily. This reduces flood peaks and velocities and the potential for erosion. In their natural vegetated state, floodplains slow the rate at which the incoming overland flow reaches the main water body. Floodplains are subject to periodic or infrequent inundation due to rain or melting snow. Flood potential is evaluated by the Federal Emergency Management Agency (FEMA), which defines the 100-year floodplain. The 100-year floodplain is the area that has a 1 percent chance of inundation by a flood event in a given year. Federal, state, and local regulations often limit floodplain development to passive uses, such as recreational and preservation activities, to reduce the risks to human health and safety.

The floodplain maps for JSC show the majority of JSC lying outside the 500-year floodplain (Figure 5). However, the eastern corner of JSC near the intersection of NASA Parkway and Space Center Boulevard and a section located along a tributary to Mud Lake in the northeastern portion of JSC are designated as lying within the 100-year and 500-year floodplains. The proposed project and associated onsite pipeline are each located outside of the designated floodplain areas.

Wetlands

The U.S. Army Corps of Engineers (USACE) regulates "waters of the U.S.", wetlands and special aquatic sites under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act. The USACE and the Environmental Protection Agency (EPA) define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands typically include swamps, marshes, bogs, and other similar areas". This definition takes into consideration three distinct environmental parameters: hydrology, soil, and vegetation (as detailed in the *1987 Corps of Engineers Wetlands Delineation Manual [USACE Manual]*). Positive wetland indicators of all three parameters are normally present in wetlands.

The U.S. Fish and Wildlife Service (USFWS) publishes National Wetland Inventory (NWI) maps that identify wetland areas; however, not all wetlands have been mapped. Five palustrine emergent wetlands, one palustrine forested wetland, and four palustrine unconsolidated bottom wetlands are indicated within JSC (Figure 5). Several site-specific wetland surveys have been conducted at JSC; however, a comprehensive investigation of the entire facility has not been conducted. Consequently, there may be wetlands located onsite that are not described within this document. A 2008 study identified eleven additional wetland areas not depicted on the USFWS NWI maps (ERT, 2008). The findings are reported in the table below.

TABLE 3.3-1: Additional Wetland Areas not Depicted on NWI

Wetland ID	Location	Description	Dimensions
W1	Near ESTA	Wetland prairie, emergent wetland, depressional flatwoods, and drainage	16.45 acres
W2	Near SE corner of Avenue A and Fifth Street	Shallow depression with emergent vegetation	0.095 acre
W3	Near Gilruth Center	Emergent wetland	3.0 acres
W4	Near Gilruth Center	Oak/tallow depressional wetland	0.01 acre
W5	Northeast portion of JSC	Shallow depression with emergent vegetation	0.02 acre
W6	Northeast portion of JSC	Shallow depression with emergent vegetation	0.01 acre
W7	Northeast portion of JSC	Shallow depression with emergent vegetation	0.70 acre
W8	Near Building 14	Shallow depression with emergent vegetation	0.4 acre
W9	Near ESTA	Depressional wetland in open grassland	Data not available
W10	Near ESTA	Several depressional wetlands in open grassland	Data not available
W11	Near Houston Lighting and Power cooling water canal	Brackish marsh fringing on drainage ditch	Data not available

None of the NWI-mapped wetlands or any of the wetlands identified by the 2008 study are located within the footprint of the proposed CHP facility or associated onsite pipeline.

3.3.2 Environmental Consequences of the Proposed Project

Evaluation criteria for effects on water resources are based on water availability, quality, and use; the existence of floodplains and wetlands; and associated regulations.

General construction impacts associated with the proposed project could temporarily affect water resources through the generation of increased storm water runoff. This increase in storm water runoff could carry sediment and contamination loads into vicinity surface waters during times of heavy rain. Increased storm water runoff occurs from developed sites as vegetation is removed and as the amount of impervious surface area increases. Typically, sediment erosion rates from construction sites are 10 to 20 times greater than those from agricultural lands, and 1,000 to 2,000 times greater than those of forest lands. The first flush of rains after a long dry period carries silt from exposed soils, and pollutants deposited on pavement, into surface waterbodies, posing a risk of contaminating water and harming aquatic life.

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 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.

Although there are no wetlands impacted by the CHP facility or associated pipeline on the JSC site, NWI maps offsite forested wetlands along Middlebrook Drive and riparian wetlands associated with Horsepen Bayou that have the potential to be impacted by the proposed upgrade to the existing offsite pipeline. However, according to preliminary discussions with CenterPoint Energy, disturbance areas would likely be limited to the tie-in locations at either end of the existing pipeline, and would occur in previously disturbed areas of the ROW.

Although none are anticipated, any wetland impacts occurring from upgrade of the offsite pipeline would be permitted and mitigated by CenterPoint Energy, thus no adverse impacts to wetlands are anticipated.

The implementation of the proposed project is not likely to have more than a minor, temporary impact on 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.

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.

No impacts to potable water supplies, the current water balance or surface water management within and proximate to JSC would occur. Overall, the potential impacts to water resources from implementation of the proposed project 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

The JSC is located in the Western Gulf Coastal Plains EPA level IV ecoregion. This area is characterized by relatively flat topography and mainly grassland potential natural vegetation. A high percent of this ecoregion is in agricultural, urban, and industrial land uses (Griffith et al., 2004).

This region has a warm, subtropical climate. Warm tropical winds from the Gulf of Mexico control the climate during the spring, summer and fall. Summers are hot and winters are mild, and the relative humidity is over 50 percent most of the year. Arctic air masses occasionally bring cold weather during late fall and winter, but the prevailing Gulf winds usually return quickly. Climatic conditions were reported from Houston's William P. Hobby Airport. Average annual rainfall is 47 inches (117 cm) (NWS, 2013). Thunderstorms are common in summer months when the sun warms the air near the surface, causing it to rise and cool, resulting in clouds and rain. Showers and thunderstorms also occur when weather fronts pass through the area. From June to November, the Gulf Coast may be struck by hurricanes and tropical storms with sustained heavy rain and strong winds. Flooding may occur in coastal areas such as JSC due to storm surge (extremely high tides caused by wind action). Winds are predominantly from the south and southeast.

3.4.1 Affected Environment

Vegetation

JSC is located in the Upper Coastal Prairie Grasslands of the Gulf Prairies and Marshes biogeographic area of Texas. This region of the Gulf Coast is a nearly level slowly drained plain, dissected by streams and rivers flowing into the Gulf of Mexico. The region includes salt grass marshes surrounding bays and estuaries and tall woodlands in the river bottomlands (TPWD, 2012).

Grasslands of the Upper Coastal Prairie were once dominated by tall grasses such as little bluestem (*Schizachyrium scoparium*), indian grass (*Sorghastrum nutans*), brownseed paspalum (*Paspalum plicatulum*), and low panic (*Dichanthelium* species). Most of the Coastal Prairie has been plowed and converted to row crops or tame pasture, which includes Bermuda grass (*Cynodon dactylon*) and King Ranch bluestem (*Bothriochloa ischaemum*). In some cases, overgrazing and fire suppression have led to the invasion or increase of native and introduced woody species including Macartney rose (*Rosa bracteata*), Chinese tallow tree (*Sapium sabiferum*), mesquite (*Prosopis glandulosa*), and huisache (*Acacia farnesiana*)(ERT, 2008).

Agriculture, grazing, fire suppression and urbanization have affected plant communities at JSC. Development has removed native plants and replaced them with cultivated turf and ornamental shrubs and trees. Undeveloped areas are maintained to keep them free of woody plants that would otherwise invade these open grasslands. Tall prairie grasses often dominate these open areas, occurring with several flowering plants. Exotic plant species such as Chinese tallow tree (*Sapium sebiferum*) have invaded native communities. The central mall and a few other buildings are landscaped. Saint Augustine (*Stenotaphrum secundatum*) and Bermuda grass (*Cynodon dactylon*) are the dominant turf grasses. The cultivated turf and ornamental shrubs and trees are maintained regularly. Most open grassland in the undeveloped areas and around some buildings, are mowed twice per year (ERT, 2008).

Drainage ditches in the open grasslands have altered drainage patterns by removing water more quickly than would otherwise occur on the flat terrain. This dries the grassland and changes its composition, allowing drought-adapted species such as Bermuda grass (*Cynodon dactylon*) and Canada goldenrod (*Solidago canadensis*) to dominate (ERT, 2008).

The area potentially affected by the proposed action is considered 'developed' in that native plant communities are displaced by planted turf and ornamental shrubs and trees. This area is maintained intensively. The area to be impacted by the project hosts two mature slash pine trees (*Pinus elliotti*) one sycamore (*Platanus occidentalis)* and Saint Augustine turf grass.

Wildlife

The Upper Texas Coast is home to many species of birds, mammals, reptiles, and amphibians. However, agriculture and urban development have fragmented and degraded wildlife habitat. JSC is surrounded by urban development on all but its north and northeast boundary, which abuts Armand Bayou Nature Center, a 750-hectare (1,900 acre) nature preserve with undisturbed wildlife habitat (Strausser, 2012).

Animals at JSC are influenced by NASA activities. Most of JSC is kept open, with little cover and food for wildlife. Large animals from Armand Bayou Nature Center are prevented from crossing Space Center Boulevard and entering JSC by a 2.5-meter (eight-foot) perimeter fence. In the developed areas, traffic and routine activities also discourage wildlife (ERT, 2008).

Mammals that may be found at JSC include white-tailed deer (*Odocoileus virginianus*), domestic and feral dogs and cats (*Canis familiaris, Felis domesticus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), nine-banded armadillo (*Dasypus novemcinctus*), nutria (*Myocastor coypus*), eastern cottontail (*Sylvilagus floridanus*), fox squirrel (*Sciurus niger*), and various bats, rats, and mice (ERT, 2008).

Reptiles and amphibians that are native to the Gulf Coast are present at JSC. Although snakes, turtles, lizards, and skinks occur throughout the site, they are most abundant in undeveloped areas. Alligators (*Alligator mississippiensis*) have been seen in the ditches. The small extent of aquatic habitat limits many amphibians, but suitable habitat for frogs and toads is available at the Houston Lighting & Power cooling water canal, the central mall ponds and in drainage ditches (ERT, 2008).

Texas A&M University manages JSC's deer population, utilizing a birth control program. The Texas Parks and Wildlife Department transfers stray alligators from Center ditches to Bay Area Park (ERT, 2008).

The JSC is located in the central flyway, a critical migratory path for hundreds of avian species. Trans-gulf migrants, species who migrate across the Gulf of Mexico, need a place to rest and feed after the arduous non-stop journey from the Yucatan (TPWD, 2013). Coastal areas are important for these species and the JSC provides resting habitat for migratory species protected under the migratory bird treaty act. Birds using uplands include red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), barred owl (*Strix varia*), Eastern screech owl (*Otus asio*), common crow (*Corvus brachyrhynchos*), killdeer (*Charadrius vociferus*), eastern meadowlark (*Sturnella magna*), mourning dove (*Zenaida macroura*), loggerhead shrike (*Lanius ludovicianus*), mockingbird (*Mimus polyglottos*), American robin (*Turdus migratorius*), blue jay (*Cyanocitta cristata*), cardinal (*Cardinalis cardinalis*), common grackle (*Quiscalus quiscula*), rock dove or pigeon (*Columba livia*), starling (*Sturnus vulgaris*), and sparrows. Birds using JSC's waters include egrets and herons (e.g., *Casmerodius albus, Ardea herodias,*

Nycticorax violacea, Nycticorax nycticorax), mottled ducks (*Anas fulvigula*), and belted kingfisher (*Megaceryle alcyon*). Ospreys (*Pandion haliaetus*) have also been sighted near JSC and are reported to nest in coastal areas of the region (Strausser, 2012).

The proposed project location is proximate to the Bernard wildlife management unit designated by the 2012 JSC Wildlife Management Plan. The 73 acre Bernard Unit has a unique clay-loam soil that supports a mosaic of wildflowers and invasive species (Strausser, 2012).

Protected Species

The Texas Parks and Wildlife Department maintains lists of both potential and currently listed state and federally endangered and threatened species that may occur within a particular county. The U.S. Fish and Wildlife Service (USFWS) maintains a list of federally endangered and threatened species and critical habitats for each species. The USFWS can provide a list of the known or potentially present threatened or endangered species or critical habitats in a specific area, upon request.

Neither threatened or endangered species nor critical habitats for threatened or endangered species are believed to exist in their natural state at JSC. The Houston toad (*Bufo houstonensis*) was reportedly observed at JSC during the 1950's, but is no longer believed to be present (ERT, 2008).

The local population of Attwater's Prairie Chicken (APC) is being restored by the Houston Zoo at a facility located within JSC. Through a Space Act Agreement, JSC licensed 1.7 acres of land to the Houston Zoo to move their captive breeding program from the zoo to JSC. The zoo is fully responsible for the operation and maintenance of the program under a permit with the USFWS (ERT, 2008).

3.4.2 Environmental Consequences of the Proposed Project

The significance of effects on biological resources is based on the importance of the resource, the proportion of the resource that would be affected relative to its occurrence in the region, the sensitivity of the resources to proposed activities and the duration of ecological effects.

The potential direct and indirect impacts to biological resources as a result of the proposed project were considered. Indirect impacts were evaluated by identifying potential habitat damage or degradation of habitats which could be associated with construction or harvesting activities.

Under the proposed project, approximately 9,240 square feet or 0.21 acres of developed, landscaped area would be permanently developed and replaced with impervious surfaces to accommodate the CHP facility.

The area potentially 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. A broad, surrounding area is maintained intensively. The area to be impacted by the project hosts two mature slash pine trees (*Pinus elliotti*) one sycamore (*Platanus occidentalis)* and Saint Augustine turf grass as ground cover. Both of these tree species are commonly planted as ornamental trees in urban areas. These trees would be replaced by plantings along the new boundary of Building 24. Any disturbed areas that are not currently developed would be revegetated following construction activities. Thus, impacts to vegetation from proposed construction activities would be minor.

The developed, landscaped area that would be converted to the proposed project footprint provides marginal wildlife habitat. Birds may utilize the trees for resting but neither tree species are significant sources of mast. 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. Regardless, JSC protects nesting species in all areas of the site, including construction areas. Restrictions up to and including temporary cessation of construction activities in a specified area could be required.

Most wildlife species that occur within JSC are adapted to living in disturbed areas and co-existing with human activity. Many of the common species are generalist species that use a variety of fragmented habitats and range over wide areas for habitat and cover (Strausser, 2012). It is anticipated that most wildlife species would be able to avoid the construction disturbance associated with the proposed project by relocation to adjacent minimally disturbed areas. Impacts to wildlife from construction activities are anticipated to be negligible to minor.

The proposed action would have no impacts on designated or preferred threatened and endangered species habitat. The APC captive breeding facility is located approximately 3,900 feet (0.73 miles) from the proposed project location. These individuals are captive within the facility prior to being released at offsite preserves, thus they do not have the opportunity to occur within the project area. Based on this distance from the facility, the scale of the proposed project, and anticipated construction and operation impacts, there would be no effects to the Attwater's prairie chicken.

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

JSC is located in the greater Houston-Brazoria-Galveston air quality region. Ambient air quality in the Houston area, including JSC, often exceeds the national standard for ozone and is considered impaired.

Ambient Air Quality Standards

The air pollutants that endanger public health are referred to as "criteria" pollutants. Each criteria pollutant has a National Ambient Air Quality Standard (NAAQS) for air quality assigned by the U.S. EPA. The NAAQS represent the maximum allowable concentrations for ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO_2), respirable particulate matter (including particulate matter equal to or less than 10 microns in diameter [PM10] and particulate matter equal to or less than 2.5 microns in diameter [PM2.5]), and lead (Pb) (40 CFR Part 50). The Clean Air Act also gives the authority to states to establish air quality rules and regulations.

TABLE 3.5-1: National and State Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard		Secondary Standard
		Federal	State	
CO	8-hour [a]	9 ppm (10 mg/m^3)	Same as Federal	None
	1-hour [a]	35 ppm (40 mg/m^3)	Same as Federal	None
Pb	Rolling 3-Month Average [b]	0.15 $\mu g/m^3$ [c]	Same as Federal	Same as Primary
	Quarterly Average	1.5 $\mu g/m^3$ [c]	Same as Federal	Same as Primary
NO_2	Annual [d]	53 ppb [e]	Same as Federal	Same as Primary
	1-hour [f]	100 ppb	Same as Federal	None
PM_{10}	24-hour [g]	150 $\mu g/m^3$	Same as Federal	Same as Primary
$PM_{2.5}$	Annual [h]	15 $\mu g/m^3$	Same as Federal	Same as Primary
	24-hour (6)	35 $\mu g/m^3$	Same as Federal	Same as Primary
O_3	8-hour [i]	0.075 ppm [j]	Same as Federal	Same as Primary
SO_2	1-hour [k]	75 ppb [l]	Same as Federal	None
	Annual (Arithmetic Average)	0.03 ppm	Same as Federal	None
	24-hour	0.14 ppm	Same as Federal	None
	3-hour [a]	None	Same as Federal	0.5 ppm (1300 $\mu g/m^3$)

Sources: USEPA 2013b

Notes: Parenthetical values are approximate equivalent concentrations.

a. Not to be exceeded more than once per year.
b. Not to be exceeded
c. Final rule signed 15 October 2008. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved. The USEPA designated areas for the new 2008 standard on 8 November 2011.

d. Annual mean.
e. The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of cleaner comparison to the 1-hour standard.
f. 98th percentile, averaged over 3 years.
g. Not to be exceeded more than once per year on average over 3 years.
h. Annual mean, averaged over 3 years.
i. Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
j. Final rule signed 12 March 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, the USEPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.
k. 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
l. Final rule signed 2 June 2010. The 1971 annual (0.3 ppm) and 24-hour (0.14 ppm) SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved. The USEPA expects to designate areas for the new 2010 standard by 2 June 2012.

Key: ppm = parts per million; ppb = parts per billion; mg/m^3 = milligrams per cubic meter; $\mu g/m^3$ = micrograms per cubic meter

The USEPA classifies the air quality in an air quality control region (AQCR) according to whether the concentrations of criteria pollutants in ambient air exceed the NAAQS. Areas within each AQCR are therefore designated as either "attainment," "nonattainment," "maintenance," or "unclassified" for each of the six criteria pollutants. Attainment means that the air quality within an AQCR is better than the NAAQS. JSC is located in a nonattainment area for the 8-hour ozone criterion (EPA, 2013).

Greenhouse Gas Emissions

Greenhouse Gases (GHGs) are gaseous emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The most common GHGs emitted from human activities include carbon dioxide (CO_2), methane, and nitrous oxide. GHGs are primarily produced by the burning of fossil fuels and through industrial and biological processes. CEQ issued draft NEPA guidance in February 2010 regarding the inclusion of analysis of GHG emissions in NEPA documents. The guidance indicates 25,000 metric tons of direct CO_2- equivalent GHG emissions could provide a useful, presumptive, threshold for discussion and disclosure of GHG emissions. However, the guidance does not propose this as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that could warrant some description in the appropriate NEPA analysis involving direct emissions of GHGs. As such, GHG emissions related to the Proposed Action are described within this Section below.

On June 3, 2010, the USEPA issued the final rule that "tailors" the applicability of Prevention of Serious Deterioration (PSD) regarding USEPA and/or permitting authorities to implement PSD permitting requirements for GHGs (75 FR 31514). The "Tailoring Rule" took effect on January 2, 2011, for new or modified sources that have the Potential to Emit (PTE) or result in a net increase in emissions more than 75,000 tons per year (tpy) of CO_2 equivalents and would be considered major for other PSD pollutants. On or after July 1, 2011, this rule will apply to any new source with PTE 100,000 tpy CO_2e and exceeds the major source threshold of any GHG on a mass basis regardless of the PTE of other PSD pollutants. Further, modifications at an existing major source that results in a net emissions increase of 75,000 tpy CO_2e also will be reviewed under the PSD rules.

The GHG PSD Tailoring rule defines a new major source of GHG emissions as emitting 100,000 tpy of CO_2e and 100 tpy/250 tpy (depending on the source category) on a mass basis. A major modification under the rule is defined as an emission increase and net emissions increase of 75,000 tons or more of GHGs on a CO_2e basis and greater than zero tpy of GHGs on a mass basis. [40 CFR 52.21(b)(49)(iv)]

JSC is already a major source, and the project GHG PTE is less than 75,000 tpy. Therefore, the project would not require GHG PSD permitting.

Regional Air Quality

Air quality at JSC is affected by local weather and regional air emissions sources. Temperature inversions caused by radiative cooling of the ground on clear nights creates a stagnant air mass near the ground, trapping pollutants. Winds bring pollutants to the Clear Lake area from Houston, to the north, and Texas City, to the south. Pollutants are also emitted by activities at JSC and by automobiles in the area.

Sources of air pollutants at JSC, other than mobile sources such as automobiles, include combustion sources (e.g., boilers), surface coating activities, laboratory hood vents, photograph processing, degreasing, woodworking, metal parts cleaning and fugitive emissions due to chemical product usage at various locations.

For JSC, the largest sources of emissions are the three boilers located at the Central Plant (Building 24) and the boiler located at the Atmospheric Re-entry Materials and Structures Evaluation Facility (ARMSEF, Building 222). Operations in Building 222 are due to be shut down prior to construction of the proposed project. The various small emergency generators located around the site and the six emergency generators located at the Emergency Power Building (Building 48), surface coating operations (Building 9), and various solvent cleaning and laboratory operations combine for an additional source of VOCs.

Nitrogen Oxides (NOx), in the presence of sunlight, combine with VOC to form low-level ozone, which is harmful to humans. NOx is a by-product of the

combustion of fossil fuels. JSC releases NOx as a result of combustion sources such as steam boilers, water heaters, and emergency generators. Permitted sources (steam boilers located at Buildings 24 and 222) contribute the vast majority of NOx. Six emergency generators located at the Emergency Power Building (Building 48) serving Mission Control also contribute to the production of NOx.

The main contributors of PM10 are the various cooling towers located throughout JSC, the three steam boilers located at the Central Plant (Building 24) and the steam boiler located at the ARMSEF (Building 222). The next major source is power generation in the Emergency Power Building (Building 48).

JSC also emits Sulfur Dioxide (SO_2) as a result of different combustion sources on site. The major sources of SO_2 are the various emergency generators located around the site. Three steam boilers located at Building 24 and Building 222 also contribute when fuel oil is utilized as a backup to natural gas. Other smaller combustion sources such as water heaters also contribute to SO_2 production.

Carbon monoxide (CO) is produced by incomplete combustion in the boilers in the Central Plant (Building 24), the ARMSEF at Building 222, and the Emergency Power generators. Other small-scale boilers and/or water heaters located throughout the site are also considered sources of CO.

3.5.2 Environmental Consequences of the Proposed Action

The environmental consequences on local and regional air quality conditions near a proposed federal action are determined based on the increases or decreases in regulated air pollutant emissions, existing conditions and ambient air quality. The evaluation criteria are dependent on whether the proposed project is located in an attainment, nonattainment, or maintenance area for criteria pollutants. Other evaluation criteria include whether major New Source Review air quality construction permitting or Title V operating permitting is triggered.

Construction of the CHP facility, the natural gas pipeline and associated infrastructure would generate emissions and dust from operation of equipment. Because construction would occur over a relatively short period, emissions from construction equipment and soil-disturbing activity would be temporary. Minimization of dust emissions during construction would be addressed through best management construction practices (BMPs).

The proposed CHP facility would consist of two natural gas combustion turbines, two heat recovery steam generators (HRSG) with associated duct burners, and a 1.1 MW backpressure steam turbine. Additionally, a 1MW black-start diesel generator would be installed to be utilized in emergency startup situations, and would be tested on a monthly basis. Tables 3.5-2 and 3.5-3 show the proposed project emissions compared to relevant permitting thresholds. Table 3.5-4 shows the difference in CO_2 emissions between proposed project and

the No Action Alternative. Although the Proposed Action would result in increased site emissions, there would be a 30 percent net reduction (combined site and source) CO_2 emissions for the proposed project compared to the No Action Alternative.

Table 3.5-2: Project Emissions and PSD Analysis

Pollutant	Project PTE (tpy)	Major Modification Threshold	Major Modification
CO	35	250	NO
NO_X	4.29	250	NO
PM_{10}	10.98	250	NO
$PM_{2.5}$	10.98	250	NO
CO_2e	74,878	75,000	NO

Table 3.5-3: Project Emissions and Non-Attainment NSR Analysis

Pollutant	Project PTE (tpy)	Netting Triggered
VOC	4.10	NO
NO_X	4.29	NO

Table 3.5-4: Comparison of CO_2e Between Existing and Proposed Facilities

CO_2e Emissions	Existing Boilers (tpy)	Proposed Turbines (tpy)	CO_2e Change	Percent Change
Site (Scope 1)	44,793	74,878	+30,085	+67.16%
Source (Scope 2)	62,188	0	-62,188	-100.00%
Combined Site and Source (Scope 1 and Scope 2)	106,980	74,878	-32,102	-30.01%

General Conformity

The General Conformity Rule ensures that the actions taken by federal agencies in nonattainment or maintenance areas do not interfere with a state's plan to meet national standards for air quality, also known as a state implementation plan (SIP).

In an area with a SIP, conformity can be demonstrated in one of four ways:

- By showing that the emission increases caused by an action are included in the SIP,
- By demonstrating that the state agrees to include the emission increases in the SIP,
- Through offsetting the action's emissions in the same or nearby area,

- Through mitigation to reduce the emission increase, or

The proposed action does not result in a net increase of emissions above the major modification thresholds as outlined in 30 TAC §116.150 for Nonattainment New Source Review for areas designated severe non-attainment for ozone. Therefore, the proposed action complies with the general conformity requirements by complying with the SIP approved program.

Other Air Quality Regulations

The construction of the CHP system would require a TCEQ standard air emissions permit; the non-rule standard permit for Electric Generating Utilities. A state of the art flue gas emissions control system would be incorporated into the design to control/reduce NOx emissions. Prevention of Significant Deterioration (PSD) requirements would not be triggered. However, it is likely that increased site GHGs would result in JSC's becoming subject to the federal mandatory GHG reporting rule.

Upon completion of construction, the CHP's emissions sources would be subject to emissions testing to validate conformance with established (new source) emissions limits, and then would be incorporated into the JSC Title V Federal Operating Permit (for future monitoring, recordkeeping, and reporting purposes).

In summary, implementation of the proposed project would have both short-term and long-term negligible net impacts to air quality. Short-term adverse effects may result from dust and air emissions during construction of the facility. However, replacing the existing utility plant at JSC with a more efficient CHP facility that reduces criteria pollutant emissions and results in a net decrease in combined site and source GHG emissions would result in a long term beneficial effect.

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).

3.6.1 Affected Environment

There are six main noise sources at JSC. Three of these sources are utilities: Central Plant (Building 24) and cooling tower, Auxiliary Chiller Facility (Building 28) and cooling tower, and Emergency Power Building (Building 48). The other sources are the Vibration and Acoustic Test Facility (Building 49), the ARMSEF (Building 222), and the Propulsion Test Facility (Building 353).

Sensitive receptors to Center noise include the Child Care Facility (Building 210); the Gilruth Recreation Facility (Building 207); the Space Center Houston Visitor Center; and homes, stores and offices outside JSC.

The Central Plant (Building 24), on Second Street southwest of Avenue B, has boilers, compressors and chillers that generate noise levels inside the building up to 95 dB(A). The Child Care Facility (Building 210), 600 meters (2,000 feet) away, is the closest sensitive receptor. It is estimated that a 36 dB(A) noise from this source would reach the facility. The nearest noise receptor outside JSC is a store 1,100 meters (3,700 feet) to the southeast, across NASA Parkway, where the noise from this source is estimated to be 29 dB(A) (ERT, 2008).

JSC's noise sources do not exceed typical conversation levels of 65 dB(A) at receptors outside JSC. The Child Care Facility (Building 210) receives up to 73 dB(A) discontinuously from noise sources; this noise level could occasionally disturb its activities. JSC evaluates and controls noise in work areas so that it will not cause loss of hearing or physical impairment (ERT, 2008).

The City of Houston has set the maximum permissible sound level for non-residential properties at 68 dB(A) at all times (Ord. No. 93-77, § 2, 1-20-93). In addition, NASA occupational health establishes site specific noise limits for JSC and requires review of construction designs prior to approval. Additionally, JSC has implemented programs such as the "Buy Quiet Program" and "Quiet by Design Program" that establish guidelines for noise generation during new construction. These regulations state that for any new equipment "JSC designers and engineers should consider noise emissions when purchasing and designing equipment that is expected to generate noise emission levels of concern for hearing conservation (80 dB(A) or higher)."

3.6.2 Environmental Consequences of the Proposed Action

Noise impact analyses typically evaluate potential changes to the existing noise environment that would result from implementation of a proposed project. Potential changes in the acoustical environment can be beneficial (i.e., if they reduce the number of sensitive receptors exposed to unacceptable noise levels or reduce the ambient sound level), negligible (i.e., if the total number of sensitive receptors to unacceptable noise levels is essentially unchanged), or adverse (i.e.,

if they result in increased sound exposure to unacceptable noise levels or ultimately increase the ambient sound level). Projected noise effects were evaluated qualitatively for the alternatives considered.

The proposed construction activities would generate temporary increases in noise at JSC. Noise would be generated by construction equipment. Individual pieces of heavy equipment typically generate noise levels of 80 to 90 dB(A) at a distance of 50 feet. With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of active construction sites. The zone of relatively high construction noise levels typically extends to distances of 400 to 800 feet from the site of major equipment operations. Locations more than 1,000 feet from construction sites seldom experience appreciable levels of construction noise.

TABLE 3.6-1: Noise Levels Associated with Outdoor Construction

Construction Phase	dB(A) at 50 feet from Source
Ground Clearing	84
Excavation, Grading	89
Foundations	78
Structural	85
Finishing	89

Source: USEPA 1974

Although construction-related noise effects would be minor, contractors and construction workers would limit construction primarily during normal weekday business hours, and properly maintain construction equipment mufflers. Noise effects on construction personnel could be limited by ensuring that all personnel wear adequate personal hearing protection to limit exposure and ensure compliance with federal and NASA health and safety regulations

The proposed location of the CHP facility is adjacent to the largest noise generator on JSC, the Building 24 Utility plant, which can reach noise levels of 90 dB(A) within the building. The area where the CHP would be built is a high traffic, developed area.

Additional noise generated by the CHP during operation is expected to be a minor addition to the noise generated by the existing facility. Any additional noise from the CHP would be primarily contained within the expansion of Building 24 and be similar to existing conditions. Therefore, no impacts to sensitive receptors are anticipated with the addition of the CHP facility.

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 LAND USE

3.7.1 Affected Environment

JSC is located within an urban, developed area. Land uses include, industrial, residential, commercial and recreational in the surrounding areas. JSC lies within City of Houston jurisdictional boundaries (ERT, 2008).

The JSC Master Plan divides the center into four areas by major activities to guide future development. Building 24 and the immediate area surrounding the facility is located in Area I, zone S-9(ERT, 2008).

Area I, the southeast section, includes the main complex of permanent buildings in the primary architectural style of JSC. Zone S-9 within Area I is a 4.5 hectare area zoned for activities associated with the Central Utilities Plant (ERT, 2008).

3.7.2 Environmental Consequences of the Proposed Action

The proposed CHP would be constructed in an area zoned for utilities and energy generation among existing utility facilities and proximate to a parking lot and an open, undeveloped area. The footprint of the proposed expansion is less than 10,000 square feet. Because of the small scale of the proposed project and existing infrastructure, no changes in land use or impacts or significant changes on the visual scale of the Project area are anticipated.

Therefore only negligible changes in land use are expected as a result of 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 land use would occur from this alternative.

3.8 CULTURAL AND HISTORIC RESOURCES

"Cultural resources" is an umbrella term for many heritage-related resources defined in several federal laws and EOs, including the National Historic Preservation Act (NHPA), the Archeological and Historic Preservation Act, the American Indian Religious Freedom Act, the Archaeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act. The NHPA focuses on cultural resources such as prehistoric and historic sites, buildings and structures, districts, or other physical evidence of human activity considered important to a culture, a subculture, or a community for scientific,

traditional, religious, or other reasons. Such resources might provide insight into the cultural practices of previous civilizations or retain cultural and religious significance to modern groups. Section 106 of the NHPA (36 CFR Part 800) requires Federal agencies to assess and determine the potential effects of their proposed undertakings on historic properties (e.g., sites, buildings, structures, and objects) and to develop measures to avoid or mitigate any adverse effects. Historic properties are cultural resources that are listed in or eligible for listing in the National Register of Historic Places.

3.8.1 Affected Environment

The Clear Lake area was inhabited for two thousand years, until around 1815, by the Orcoquisac Indians. These agriculturalists lived along the bayous. The Karankawas, a tribe related to the Orcoquisac by language, lived just to the west and entered the Clear Lake area around 1815. The nomadic Karankawas did not raise crops and resisted attempts by Spanish missionaries to introduce European culture (Barker, 2013).

Around 1820, the Clear Lake area also became attractive to settlers of European origin. To entice Americans to come to Texas, the government of Coahuila and Texas offered choice land grants to immigrants. Moses Austin and Stephen F. Austin, among others, contracted to bring colonists to Texas, and the first three hundred immigrants included settlers to the Clear Lake area. The Clear Creek Development Company was formed in 1860 to sell town lots, and the town of Clear Creek (now League City) was developed (Henson, 2013).

A major stimulus to the early development of the area was the beginning of the Gulf Coast rice industry, started by Japanese Seito Saibara in 1903. Saibara came at the invitation of the Houston Chamber of Commerce to introduce a Japanese rice cultivar. This breed of rice nearly doubled rice production per acre in coastal Texas and Louisiana. Saibara's rice operation grew to a thousand acres as he became instrumental in establishing the Gulf Coast rice industry. Evidence of rice farming still persists on the landscape today. Linear ditches, swells, roadways, and dikes helped direct the flow of irrigating water over rice crops that are long since gone (Wilks, n.d)

Early twentieth century maps of Harris County (1903 and pre-1911) indicated that the land now developed as JSC, located south of Horsepen bayou, was owned by Sara Deel; Robert Wilson owned the property directly south of Deel. In 1930, James Marion West, an early lumber and oilman, developed his family home and ranch in southern Harris County. He raised cattle and maintained his ranch as a preserve for deer, quail, peccary and prairie chickens. In 1938, the Humble Oil and Refining Company (later, Exxon Company, U.S.A.) purchased 30,000 acres of the west property for 8.5 million dollars, including the family ranch, for its oil and gas resources. Humble Oil developed two oil fields, Clear Creek and Friendswood (ICRMP, 2013).

In 1961, Humble donated a large tract of the land to Rice Institute, which in turn donated or sold the land to NASA for development of the Manned Spacecraft Center (MSC; now JSC). Also around this time, Humble Oil announced plans to develop 15,000 acres of the West property for residential and industrial uses. The oil company partnered with the Del E. Webb Corporation to form Friendswood Development Company, which began development of the residential part of Clear Lake City. Clear Lake City was officially established in 1963. By 1970, the population was 8000. In 1977, Clear Lake City was annexed by the City of Houston. The strong economic and population growth of Clear Lake City were stimulated by the aerospace industry (Greene, 2013).

Cultural resources at JSC have been systematically surveyed and reported in the draft JSC Integrated Cultural Resources Management Plan (ICRMP).

JSC contains two National Historic Landmarks (NHL): the Apollo Mission Control Center and Viewing Room (Building 30) and the Space Environment Simulation Laboratory (Building 32). In addition to these resources, 16 buildings and seven structures were determined eligible for listing in the National Register of Historic Properties (NRHP). The cultural and historic resources identified at JSC are detailed in Table 3.8-1 below and the buildings are depicted in Figure 7.

TABLE 3.8-1: Cultural and Historic Resources Identified at JSC

Designation	Building Number	Description of Resource
NRHP	49	Vibration and Acoustic Test Facility
NHL	32	Space Environment Simulation Lab
NRHP	33	Space Environment Effects Laboratory
NRHP	9	Systems Integration Facility
NRHP	44	Communications and Tracking Development Laboratory
NHL/NRHP	30	Mission Control Center
NRHP	7	Crew Systems Laboratory
NRHP	16	Avionics System Laboratory
NRHP	5	Jake Garn Mission Simulator and Training Facility
NRHP	35	Mission Simulation Development Facility
NRHP	222	Atmospheric Reentry Materials and Structures Evaluation Facility
NRHP	350	Energy Systems Support Laboratory
NRHP	351	Power Systems Test Facility
NRHP	352	Pyrotechnics Test Facility
NRHP	352 A	Pyrotechnic Test Cells
NRHP	354	Cryogenics Test Facility
NRHP	356A	Fluid Systems Test Building
NRHP structures	N/A	Discovery OV-103
NRHP structures	N/A	Atlantis OV-104

Designation	Building Number	Description of Resource
NRHP structures	N/A	Endeavour OV-105
NRHP structures	N/A	Retrieval ship Freedom Star
NRHP structures	N/A	Retrieval ship Liberty Star
NRHP structures	N/A	Shuttle Carrier Aircraft N911NA
NRHP structures	N/A	Shuttle Carrier Aircraft N905NA

A systematic professional archaeological field survey was conducted at JSC in December 2012. As a result, no recorded archaeological sites are located within the Center and there exists a low probability that significant NRHP or SAL-eligible archaeological cultural resources exist in the surveyed areas. 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 (ICRMP, 2013).

3.8.2 Environmental Consequences of the Proposed Action

The Area of Potential Effect (APE) for this project includes Building 32, Space Environment Simulation Laboratory (SESL), a National Historic Landmark, and Building 33, Communications Tracking and Development, eligible for listing on the National Register of Historic Places under the U.S. Space Shuttle Program. The proposed project would be constructed in a style concurrent with existing buildings in the immediate area. Therefore, visual impacts to the NHL or NRHP-eligible properties within the JSC would be mitigated.

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.

Consultation with the Texas State Historic Preservation Officer (SHPO) has not yet been conducted by the JSC Historic Preservation Officer regarding the Proposed Action. Consultation is pending on the historic survey of Building 24 to determine its eligibility. Mitigation of the undertaking will be based on the determination of eligibility. Based on this consultation and the minimal change to the overall appearance of Building 24, no visual impacts to historical resources are anticipated as a result of the Proposed Action.

3.8.3 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.

3.9 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

3.9.1 Affected Environment

JSC is located in the Bay area, which is bounded by Interstate 45 to the west, FM 2351 (Clear Lake City Boulevard) to the north, Galveston Bay to the east, and FM 518 to the south. The region covers 650 square kilometers (250 square miles) and includes parts of two counties and ten cities. JSC is the largest employer of the Bay area.

Growth in the Bay area slowed in the first part of the 1980s due to the oil industry recession, but less so than in other parts of the Houston area. Since 1987, with federal commitment to the International Space Station and renewed growth in the oil industry, the Clear Lake area population has grown at an increasing rate. The Bay area has grown from approximately 375,000 people in 1998 to 425,000 people in 2008, which is an annual rate of approximately 5,000 persons per year (Figure 21). The population is estimated to reach 550,000 by 2020. Most of the growth is in the planned communities of the Bay area (part of the City of Houston), League City, and Seabrook (ERT, 2008).

The Clear Lake area is demographically different from the Houston area because of JSC. Its employment base, income level and education profile are above the regional average. Its chemical producers and aerospace firms are better insulated from the cycles of the oil industry. The area's economic base has four major industries: aerospace, petrochemical, tourism and recreation (ERT, 2008).

Tourism is the fastest growing industry in the Clear Lake area. Currently, about one million tourists visit JSC each year. In 1992, Space Center Houston, designed by the Disney organization, opened as JSC's visitor center. The Clear Lake Area Chamber of Commerce has drawn over 11 million visitors to the new center since 1993, resulting in between $57 million and $99 million annually to the local economy (ERT, 2008).

Executive Order 12898 states that “each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

3.9.2 Environmental Consequences of the Proposed Action

The proposed action is not anticipated to trigger significant changes in the socioeconomics of the community surrounding the JSC. The Clear Lake area does not represent an Environmental Justice concern due to employment, income, and education exceeding the regional averages.

3.9.3 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 to socioeconomics or potential environmental justice concerns would occur from this alternative.

3.10 TRANSPORTATION

3.10.1 Affected Environment

Transportation to JSC for most employees is by private automobile. JSC has gates on NASA Parkway to the south, Space Center Boulevard to the east and north, and Saturn Lane to the west. Traffic on NASA Parkway is generally crowded during the morning and afternoon rush hours; the road was widened in 1997 and construction was completed in 2008 creating a Webster bypass to facilitate the east-west movement of vehicles along NASA Parkway toward the Gulf Freeway (IH 45). Based on the Environmental Assessment prepared for this roadway expansion, Table 19 shows estimated traffic volumes on major roads around JSC (ERT, 2008).

Automobiles and trucks reach the Clear Lake area on State Highway 3, State Highway 146 and Interstate 45. NASA Parkway connects these roads with the main gate to JSC.

Railroads run parallel to State Highway 3 and State Highway 146. The Southern Pacific provides freight rail service to Seabrook, and the Missouri-Kansas-Texas Railroad serves Webster. JSC does not have any direct rail service (ERT, 2008).

3.10.2 Environmental Consequences of the Proposed Actions

Temporary increases in traffic due to incoming construction materials and equipment are anticipated as a result of the proposed action. The increases in traffic would be mitigated through coordination and traffic management BMPs. Impacts to traffic would be temporary in nature and are unlikely to have significant impacts on traffic outside of JSC.

3.10.3 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 transportation would occur from this alternative.

3.11 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

Solid waste is any waste material; hazardous waste is solid waste that is flammable, corrosive, reactive, toxic, or listed by the U.S. EPA. JSC generates and stores large quantities of solid and hazardous wastes and is registered by the

TCEQ. Hazardous waste is not accumulated or managed at JSC for longer than ninety (90) days; consequently JSC is not required to have a storage permit issued by the TCEQ. Additional information regarding hazardous waste management at JSC is available in the 2008 Environmental Resources Report (ERT, 2008).

3.11.1 Affected Environment

NASA has procedures to minimize how much hazardous waste is produced, control its handling, and avoid environmental pollution. Specific pollutants and contaminants were targeted for reduction in the JSC 5-year Source Reduction and Waste Minimization Plan submitted to the TCEQ in January 2005. Wastes targeted for reduction include metal finishing wastes, solvent wastes, wastewater containing organics, solid waste, and total quantities of hazardous waste.

Metal finishing in the Technical Services Facility (Building 9) generates spent concentrated baths and rinse water. These wastes were previously accumulated in tanks until shipped for treatment; based on the volumes generated, with the exception of the dilute rinse water wastes that are pretreated and discharged to the sanitary sewer, these wastes are no longer collected in the tanks. The six inactive tanks were formally closed and removed in November 2008.

Waste solvents and oils are generated by maintenance activities such as painting, compressor cleaning and degreasing. These wastes are stored at the Hazardous Waste 90-day Accumulation Facility (Building 358) until they are removed for disposal.

Other hazardous wastes include sludge from oil-water separators, wastewater containing hazardous organic compounds, lab packs, plating filter cake, contaminated filter media, used batteries, and contaminated rags. Hazardous wastes are also generated when spills are cleaned up and contamination is removed.

Hazardous wastes are managed at the Hazardous Waste 90-day Accumulation Facility (Building 358). JSC only accumulates non-hazardous rinse water within the accumulation tank at the Technical Services Facility (Building 9).

The Hazardous Waste 90-day Accumulation Facility (Building 358) is the central storage site for hazardous waste. Waste is generated at various points around JSC and transferred to this building to be prepared for shipment to disposal sites. Transport vehicles take the wastes to federal/state and NASA approved/audited private hazardous waste disposal operations.

Non-hazardous municipal-type non-putrescible refuse is taken to roll-off boxes at the Central Waste Collection Facility (building 332) and shipped to a permitted landfill. Non- hazardous municipal-type solid waste, including construction and demolition debris (e.g., concrete, scrap metal) paper, cardboard, wood, and

plastic refuse, are picked up by a commercial transporter and transported for recycling or disposal as appropriate.

Asbestos, a Class I industrial solid waste, is temporarily accumulated at the point of generation (for large construction projects) in sealed conex boxes or are transferred to sealed conex boxes near the Hazardous Waste 90-day Accumulation Facility (Building 358) until shipped to an approved landfill, in conformance with applicable TCEQ and USEPA NESHAP and industrial solid waste regulations as well as NASA's offsite disposal policy. Electrical equipment containing polychlorinated biphenyls (PCBs) become industrial solid waste as electrical equipment is replaced. These wastes materials are temporarily accumulated in the Hazardous Waste 90-day Accumulation Facility (Building 358) until shipped off site for disposal. Section 11 includes a discussion of asbestos and PCBs at JSC.

Several types of wastewater are generated at JSC. These include domestic sewage, plating shop rinse water, laboratory wastewater, blow-down water from cooling towers and boilers, and oily wastewater from the vehicle garage and maintenance shops. JSC monitors for compliance with discharge limits by collecting weekly grab samples at Manhole "M", which are indicative of sanitary wastewater quality leaving JSC, and compares the results to the effluent and heavy metals limits established.

The cooling and heating systems at Buildings 24, 28, and 48 include evaporative cooling towers that use water containing non-chromate corrosion inhibitors. Blow-down from the cooling towers is discharged to the sanitary sewer.

Asbestos was used in the construction of buildings and facilities when JSC was built in 1961 and in additions through the 1970s. It was used for fireproofing, acoustical ceilings, ceiling tiles, pipe and boiler insulation, floor tiles and mastics, pipes, cooling towers and fiberboard products. Table 16 lists the buildings in which asbestos is known to exist; a searchable database is maintained by the Occupational Health Office. The National Emission Standards for Hazardous Air Pollutants (40 CFR 61) require that suspect materials be inspected and sampled before being disturbed; the Occupational Health Office's on-site laboratory is licensed and accredited to perform asbestos analysis.

NASA has established procedures for handling asbestos while performing maintenance and while renovating or demolishing buildings. Although all painting currently uses non-toxic paints, some buildings at JSC still have lead-based paint. Abatement of lead based paint must follow the precautions established within the JSC Safety Handbook. JSC has almost completely eliminated the use of polychlorinated biphenyl compounds (PCBs) within the various electrical transformers (all are less than 50 ppm).

Spills or unplanned releases of toxic substances to the environment occur infrequently at JSC. When a small amount of a toxic substance is spilled, it is cleaned up by the JSC Spill Team and transferred to the Hazardous Waste 90-day

Accumulation Facility (Building 358). If a large amount is spilled, special equipment may be needed to contain or clean up the spill. The JSC Environmental Support Contractor (JES) maintains in-house capabilities and subcontracts for support when necessary. The Houston Fire Department and Hazmat Team are available to respond to spills and hazardous situations. NASA has an environmental contingency plan (Appendix 4), prepared in accordance with JSC 05900, describing equipment and procedures for responding to environmental emergencies, such as hazardous material spills.

JSC's Environmental Management System, documented in Johnson Space Center Procedural Requirement (JPR) 8553.1, and Environmental Compliance Procedures, documented in JPR 8550.1, establish the framework to control or prevent releases of toxic substances into the environment. JSC is subject to a variety of regulatory controls and permits. In addition to routine day-to-day monitoring and inspections performed by JSC's environmental staff/contractor personnel, unannounced regulatory agency inspections and triennial multimedia Environmental Functional Reviews (EFRs) periodically assess how well JSC is performing to minimize any impact to the environment. Based on Executive Order 13423, JSC is making strides to reduce its environmental footprint through construction of sustainable buildings, substitution and elimination of toxic materials, such as ozone depleting substances, whenever possible, and active energy/water conservation programs.

3.11.2 Environmental Consequences of the Proposed Action

Impacts on hazardous materials or solid and hazardous waste would be considered significant if the proposed project resulted in noncompliance with applicable Federal or state regulations, or increased the amounts generated or procured beyond current community waste management procedures and capacities.

Construction of the proposed CHP facility and heat distribution system would generate some amount of non-hazardous solid waste, including metal piping, fiberglass insulation, paper, plastics, glass, and other typical construction waste. The construction debris would be picked up by a commercial transporter and transported for recycling or disposal as appropriate.

Used oil generated from the proposed project would be collected and reused after filtering, using a used oil blender that blends clean and filtered used oil. Drained oil filters, air filters, and used lubricants and grease which cannot be reused would be disposed of in the local landfill, as currently occurs.

JSC's compliance record (prepared by TCEQ) and audit evaluations (prepared by NASA Headquarters) have consistently documented that JSC operates a strong compliance program and causes minimal adverse impacts to human health and the natural environment from its research and development activities. The comprehensive management of hazardous materials within JSC ensure proper procedures and controls are in place to mitigate any changes in hazardous

material generation and waste management that may occur as a result of the proposed action.

A 12,000 gallon tank containing 19% aqueous ammonia would be located northwest of the proposed CHP facility and immediately north of the existing cooling towers. Aqueous ammonia would be utilized in a selective catalytic reduction to convert NOx to NO2 and water and reduce overall NOx emissions. Ammonia is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes. Exposure to aqueous ammonia may cause severe chemical burns to the eyes, lungs and skin. To manage this hazardous material, JSC would adhere to the standards established in their environmental and health and safety protocols.

No hazardous materials generation is anticipated during construction of the CHP. Small amounts of construction debris would be generated and properly disposed of; therefore the overall impact of construction waste is considered negligible. Any hazardous material generated during operation of the CHP would be managed under existing protocols to ensure that no adverse impacts result from the Proposed Action.

3.11.3 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 hazardous materials and waste management would occur from this alternative.

3.12 HUMAN HEALTH AND SAFETY

3.12.1 Affected Environment

Health services in the Clear Lake area are adequate to handle JSC's employees and the community. Columbia Clear Lake Regional Medical Center is the largest hospital in the area, with 459 beds, over 1,100 employees and advanced medical technology. Baywood Hospital is a psychiatric hospital with 150 beds in Webster. St. John Hospital has 141 beds and handles acute care of medical, surgical, obstetrical and pediatric patients. Clear Lake Rehabilitation Hospital is a physical rehabilitation hospital with 60 beds for patients with disabling injury or illness. Nursing homes for the elderly and physically handicapped include the Harbourview Care Center in League City, Manor Care in Webster, and Lakeview Health Care Center in Webster. The Clear Lake Emergency Medical Corps handles local emergencies.

JSC maintains a Health and Safety Handbook and a comprehensive Quality Management System. JSC personnel, both civil service and contractor, are required to obtain training and in some cases to be certified to perform functions that require formal training.

3.12.2 Environmental Consequences of the Proposed Action

The proposed project would involve construction and operation of the CHP facility. The construction project manager responsible for construction of the CHP facility and the heat distribution system would be responsible for compliance with applicable OSHA regulations governing construction activities (29 CFR 1910 and 1926), and any additional site-specific safety measures that concern occupational hazards at the project site for all construction workers and site visitors. The general worker safety standards covered in OSHA regulations include walking-working surfaces, means of ingress and egress, operation of power equipment, adequate ventilation, noise exposure controls, fire protection, and electrical equipment safeguards.

Once the proposed CHP is operational, OSHA procedures would continue to be followed to minimize worker exposure to health and safety risks. These would include controls, warning systems and alarms to detect elevated temperature/ pressure in the generator equipment or hazardous gasses within the plant expansion.

Based on the scale, duration, and complexity of the proposed project and the exemplary health and safety record at JSC, construction and operation of the CHP facility represent a marginal impact to health and human safety.

3.12.3 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, no construction or operation would occur. There would be no new risks to human health and safety. Existing conditions would continue. Therefore, no impacts to human health and safety would occur.

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

The scope of the cumulative effects analysis involves both timeframe and geographic extent in which effects could be expected to occur. All relevant past, ongoing activities and reasonably foreseeable actions in and around the JSC were initially considered for potential cumulative effects. Activities that could have additive environmental effects associated with the proposed project were retained for further analysis and are described below.

4.1.1 Actions Considered with Potential Cumulative Impacts

The proposed project would initiate construction in early to mid-2015, with initial operation of the CHP occurring in late 2016. Other construction and demolition projects at JSC occurring between 2015 and 2016 have the potential to result in cumulative impacts to environmental resources at JSC.

As part of the long term planning process at JSC, NASA plans to demolish 12 buildings between 2013 and 2017. Removal of these buildings would decrease the overall building footprint on JSC by thousands of square feet. One renovation is currently underway at JSC to convert the north wing of Building 45 to a new medical clinic. One new construction facility, Building 21, is planned for 2014-2015.

The demolition and construction of these facilities would adhere to JSC best practice protocols and standards. As such, they have similar potential for minimal impacts to noise, traffic, air emissions, and storm water runoff as the CHP facility.

In the event that any of the construction and demolition projects described above occur concurrently with the construction of the proposed project, there is a potential for short term cumulative effects. Once the construction and demolition projects are complete, no additional operational impacts are anticipated.

4.1.2 Cumulative Impacts Analysis

As described in previous sections, the proposed project would result in negligible to minor direct and indirect impacts on the environment, and would result in beneficial impacts through a net increase in energy efficiency and a net decrease in combined site and source CO_2 emissions. Because the direct and indirect impacts of the Proposed Action would be small, the contribution of the project to the cumulative effects from all reasonably foreseeable future projects would also generally be small. The potential for cumulative effects on noise, traffic, air emissions, and storm water runoff resulting from the Proposed Action are analyzed below.

Noise
Concurrent construction at the JSC may lead to an increase in overall background noise levels. Each project would have controls and BMPs in place to minimize noise impacts. It is not expected that the noise generated during construction and demolition activities would be of significant magnitude and duration to result in a significant impact to human and environmental receptors.

The other JSC projects are not expected to result in significant operational noise, thus there are no cumulative effects on noise with regards to operation of the proposed CHP.

Traffic
The concurrent construction could cause increases in traffic and congestion on the JSC campus. Large construction vehicles and materials could cause temporary road closures and disrupt the flow of traffic within the JSC campus. It is anticipated that JSC operational and project management staff would anticipate these potential issues and work to mitigate any traffic or congestion caused by construction. The influx of construction workers could lead to more individual vehicle traffic within the JSC. These impacts would be short term and would revert to baseline conditions once construction is completed. Thus there would be no cumulative effects on traffic with regards to operation of the CHP.

Air Emissions
Planned construction activities would each result in emissions of particulate matter. Although the emissions from each activity would be temporary and localized, overlapping construction schedules could potentially lead to longer-term adverse effects on air quality at JSC.

Additional air emissions would result from fuel-burning internal combustion engines (e.g., heavy equipment and earthmoving machinery) utilized during the construction and demolition projects. These emissions could temporarily increase the levels of some of the criteria pollutants. To reduce the emission of criteria pollutants, fuel-burning equipment running times would be kept to a minimum and engines would be properly maintained. This temporary increase in emissions would not be expected to impact long-term air quality or visibility in the region.

The other JSC projects would not be expected to result in significant operational air emissions, thus there would be no cumulative effects on air emissions with regards to operation of the proposed CHP.

Stormwater Runoff
The planned construction could result in increased stormwater runoff that has the potential to convey sediment and pollutants to surface waters. JSC has a general permit from TCEQ to discharge stormwater that requires the development of a Storm Water Management Program and Plan (SWPPP). As detailed in this plan, JSC uses a wide variety of BMPs to limit the potential for stormwater contamination, including conducting construction awareness training, implementing Sedimentation and Erosion Control (SEC) Plans, incorporating BMPs into construction specifications, conducting regular inspections, participating in Leadership in Energy and Environmental Design (LEED) certifications, and maintaining spill response and pollution prevention programs.

The use of these BMPs is intended to protect nearby streams and waterways from contamination to the maximum extent practicable, thereby promoting water quality, improving aquatic habitat, and reducing the risk of threatened water supplies. Concurrent construction and demolition projects would also utilize these BMPs, thus cumulative adverse effects from stormwater runoff would not be expected for construction or operation of the projects.

The overall cumulative effects of the construction of the proposed CHP facility and concurrent construction and demolition projects would be expected to be temporary and minor. Based on current conditions and anticipated projects at JSC, NASA has concluded that the Proposed Action could contribute to cumulative adverse effects on traffic and noise levels during construction, but the scale and short-term nature of these impacts would have no more than a negligible cumulative effect. No cumulative impacts from operation of the Proposed Action would be anticipated.

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