

Independent spatial data analyses of the 2019 Chickahominy Power Plant, Charles City County, Virginia, for environmental justice, indigenous tribal lands and Significant Impact Levels (SILs) of modeled project emissions.

Project & Analyses Introduction:

In August 2017, Chickahominy Power, LLC (Applicant) - a subsidiary of Balico, LLC - filed with the Virginia State Corporation Commission an application for a 1,650 MW shale gas plant to be situated in Charles City County, Virginia. The project has progressed through an administrative course and is currently in final phases of air permitting with [Virginia's Department of Environmental Quality \(VDEQ\)](#). The next action will be [formal consideration](#) with the State Air Pollution Control Board, June 21, 2019.

The project features one of two options (GE 7HA.02 option) or (MHPS M501J option):

- Three General Electric (GE) 7HA.02 class natural gas-fired combustion turbine generators, each provided with a HRSG and a steam turbine generator.

or

- Three Mitsubishi Hitachi Power Systems (MHPS) M501JAC class natural gas-fired combustion turbine generators, each provided with a HRSG and a steam turbine generator.

Named for the Chickahominy Nation, indigenous peoples populating lands of east central Virginia near Richmond for centuries and on whose historical lands the project would be sited, this gas-fired plant is anticipated to be completed in the spring of 2022. The project is situated at the 185-acre existing Dominion Energy Chickahominy Substation site, and is crossed by two Dominion transmission lines and a 16-inch Virginia State Gas pipeline. The project is the third major energy generator proposed for Charles City County in just four years. Immediately northwest of this large project, county Board of Supervisors approved an 1,060 MW shale gas power plant known as the [C4GT Power Station](#) which has not yet broken ground as of June, 2019.

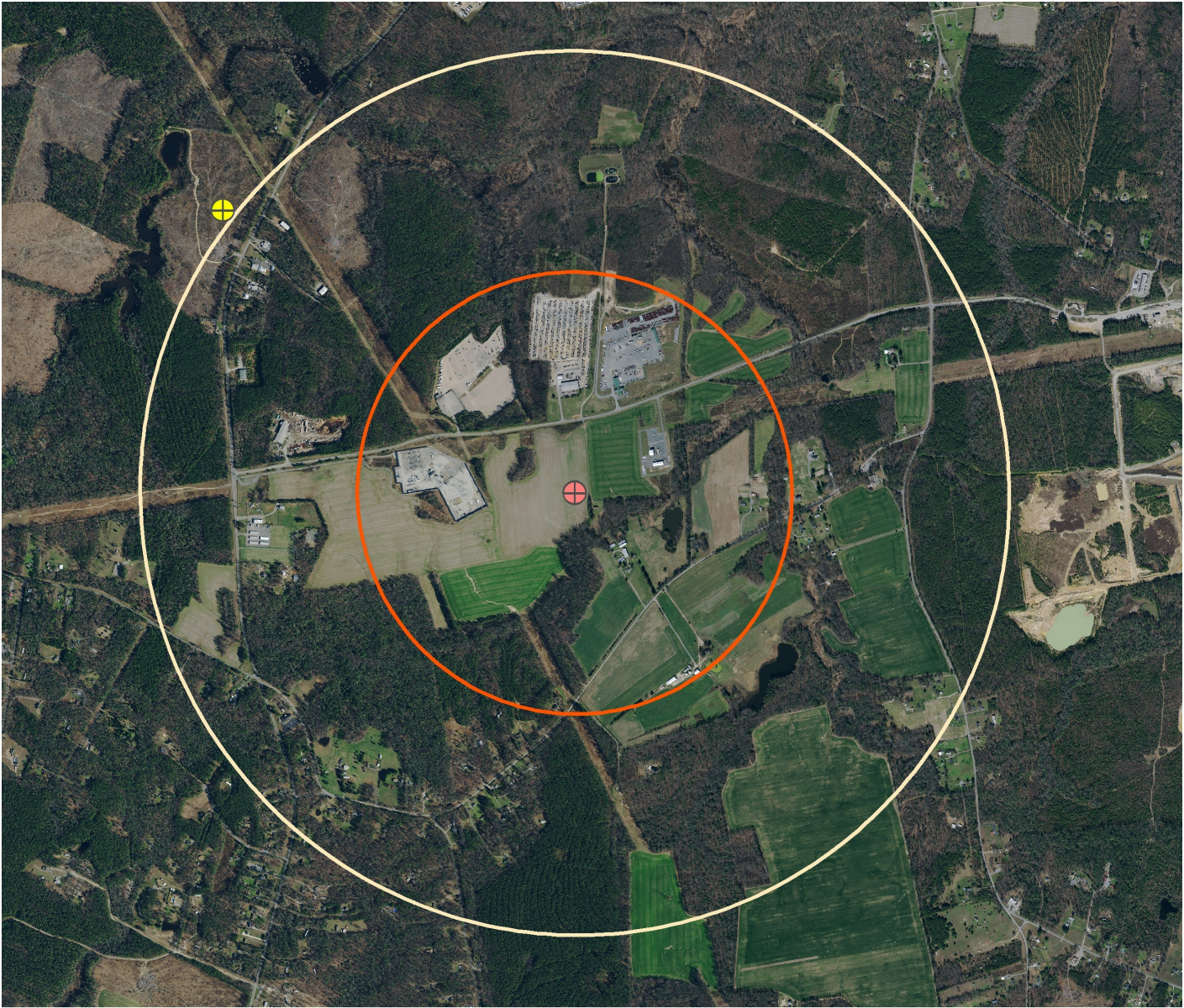
The analyses in this document utilize various US Census data products; spatial data available from [Virginia's Geospatial Repository VGIN](#); [EIA.gov](#) spatial data; and modeling documents posted at the [DEQ project site](#). Importantly, while the project was originally filed in 2017, revised applications were performed in November 2018 and most recently, January 2019. Much of the analyses in this document is related to emission modeling found in the latter 'Revision 3' [application package](#). Broken into 4 sections, the analyses for demography, environmental justice and modeled emissions are briefly summarized as follows:

- **Project site location and characteristics:** Overview of spatial characteristics of project location with an emphasis on proximity to transmission lines, accessible 16" gas pipeline and the C4GT Power Station location. Further discussion of the Chickahominy plant proposal relative to gas-fired plants nationwide finds this proposal to be atypical both in size and proximity relative to the majority of other plant location configurations.
- **Baseline demographic and population density analysis:** Mapping and discussion of project area demographics relative to Virginia State, with a focus on minority and poverty rate US Census variables derived from the American Community Survey 2012-16 (ACS). Further consideration of a population density proxy via Virginia's address features dataset, as well as simple weighted apportionment methods.
- **Environment Justice and indigenous tribal lands analysis:** Mapping and discussion of Environmental Justice eligible geographies, local indigenous tribal land and demographic variables from ACS pertaining to the American Indian race designation.
- **Spatial dispersion and concentration of modeled impacts:** Review of emissions modeling summarizations from project AERMOD runs as found in the 'Revision 3' application package. Particular attention is given to background emissions and site proximity to the future C4GT Power Station northwest of the project site. Emission isopleth maps per pollutant found in [Appendix G](#) are reviewed relative to localized populations.



Project site location and characteristics:

As seen in the following Site Location map (page 2), the proposed Chickahominy project (Pink Marker) is situated on 185 acres of cultivated land adjacent to a current transmission station (Chickahominy Substation) which in turn is crossed by two Dominion transmission lines and an existing 16" Virginia State gas pipeline. Approximately 1 mile to the east is the Charles City Municipal Landfill which features an onsite gas plant (16 MW) operated by [Ingenco](#). Northwest of the project situated at the 1 mile proximity distance is the future site of the C4GT facility that ostensibly will be fed via the same 16" existing gas pipeline as the Chickahominy project. The confluence of exceptional size (a combined output of 2,710 MW) and close proximity deems this geography unique amongst gas plant configurations nationwide.

A review of the U.S. Energy Information Administration dataset for powerplants would place the Chickahominy project as the 18th and the C4GT as the 116th largest gas fired plants in a total field of 1,719 plants (Gas variable as isolated from other fuel types). However, as mapped, the Chickahominy and C4GT geography portends a significant outlier in scale and proximity. On page 3, a mapping of gas plant distribution across the contiguous US accompanied by just 4 plant pairings within 1.1 miles of each other featuring a combined output of > 2500 MW underscores the rarity of this scale of output in such close proximity. Further, this is within an already narrow field of just 219 (12.7%) plant pairings - regardless of combined MW output - occurring within 1.1 miles of each other. Should both plants be built as planned, they will join this extreme subset of plant pairings of atypical MW output coupled with extreme proximity.



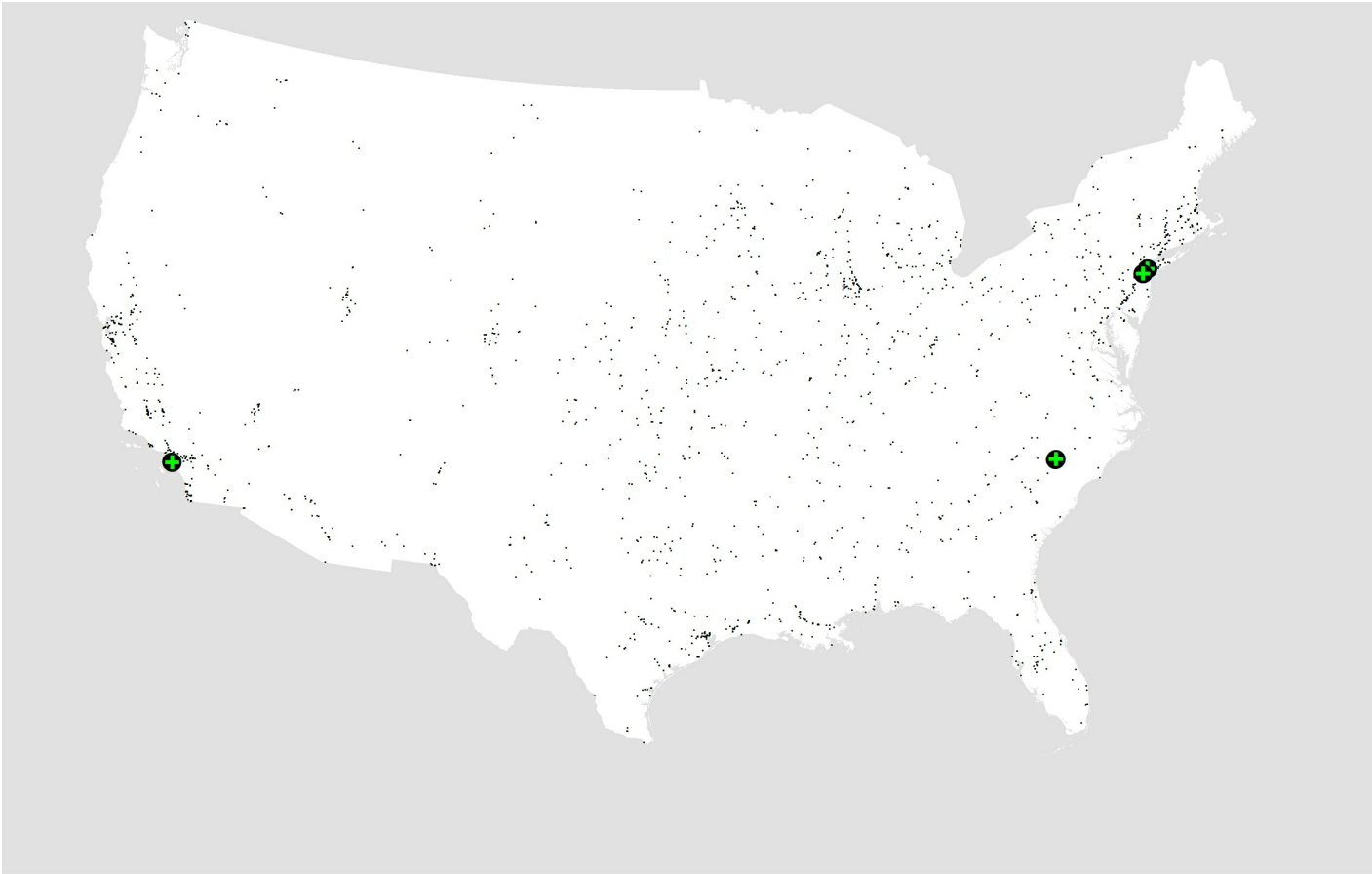
Proposed Chickahominy Power Station | Site Location

-  Proposed | Modeled Chickahominy Power Plant
-  C4GT Facility

Proximity Distances (Miles)

-  .5
-  1





Location of > 2500 MW Gas Plant Pairings | Contiguous US

- + > 2500MW Plant Pairings
- Gas Fired Power Plants

Source: *eia.gov*

Four Plant Pairings within 1.1 miles with combined output > 2500 MW:

Plant 1	Plant 2	Plant 1 MW	Plant 2 MW	Distance (miles)
AES Alamos LLC	Haynes	1922	1739.1	0.29
PSEG Linden Generating Station	Linden Cogen Plant	1740	974.1	0.85
Ravenswood	Vernon Boulevard	2535.1	94	0.45
Sherwood H Smith Jr Energy Complex	Hamlet Generating Facility	2244.8	343.8	0.33

Baseline demographic and population density analysis:

In review of publicly accessible permitting documents for the Chickahominy plant, there exists no accessible demographic analysis beyond uncontextualized statistical results produced from an [EJSCREEN report dated 1/30/2019](#) for several project proximities. In the report ([Appendix C](#)) - [Environmental Justice Reports](#) two critical demographic indicators - Minority and Low Income Populations - are reported in tabular format. EJSCREEN is a 'first pass' indicator profiler for vulnerable populations. However, it does not deliver a final eligibility decision. For such a determination, states such as New York and New Jersey have relied on [EPA region guidance](#). In the case of Region 2 of which New York and New Jersey are part, EJ geographies are generally defined as follows:

Census blockgroups with percent poverty or percent minority higher than the state threshold are considered potential EJ areas

Applying the same threshold criteria logic to the Chickahominy project at .5, 1, 2, 3 and 5 mile proximities, the argument is made for EJ inclusion based primarily on the minority variable as compared to the median of all census geographies (Census Blockgroups - CBGs) across Virginia. Derived from ACS data in the *B03002 Hispanic or Latino Origin by Race* table, vintage 2012-16, the Virginia state minority mean is 36.99% wherein the minority population is isolated from the *White Alone - Not Hispanic or Latino* population. For the poverty variable, EJSCREEN uses the census table for households; in this analysis, ACS data in the *B170001 Poverty Status in the Past 12 Months by Sex By Age* is utilized wherein the mean poverty rate was found to be 12.4%. In the following table and maps on page 5 and 6, possible EJ eligibility is denoted per intersecting CBG with an added criteria requiring an additional 50% threshold for the minority variable as utilized in the relatively recent [Atlantic Coast Pipeline Draft Environment Impact Statement \(DEIS\)](#). It should be noted this additional 50% criteria is conservative and not utilized by all [commenting parties on record](#) (see [particularly comment letter #4](#)). As a result, it is arguable whether CBG 600100-1 should fall into the *No* or the *Yes Eligibility* category.

Census Block Groups Intersections for % Minority and % Poverty variables:

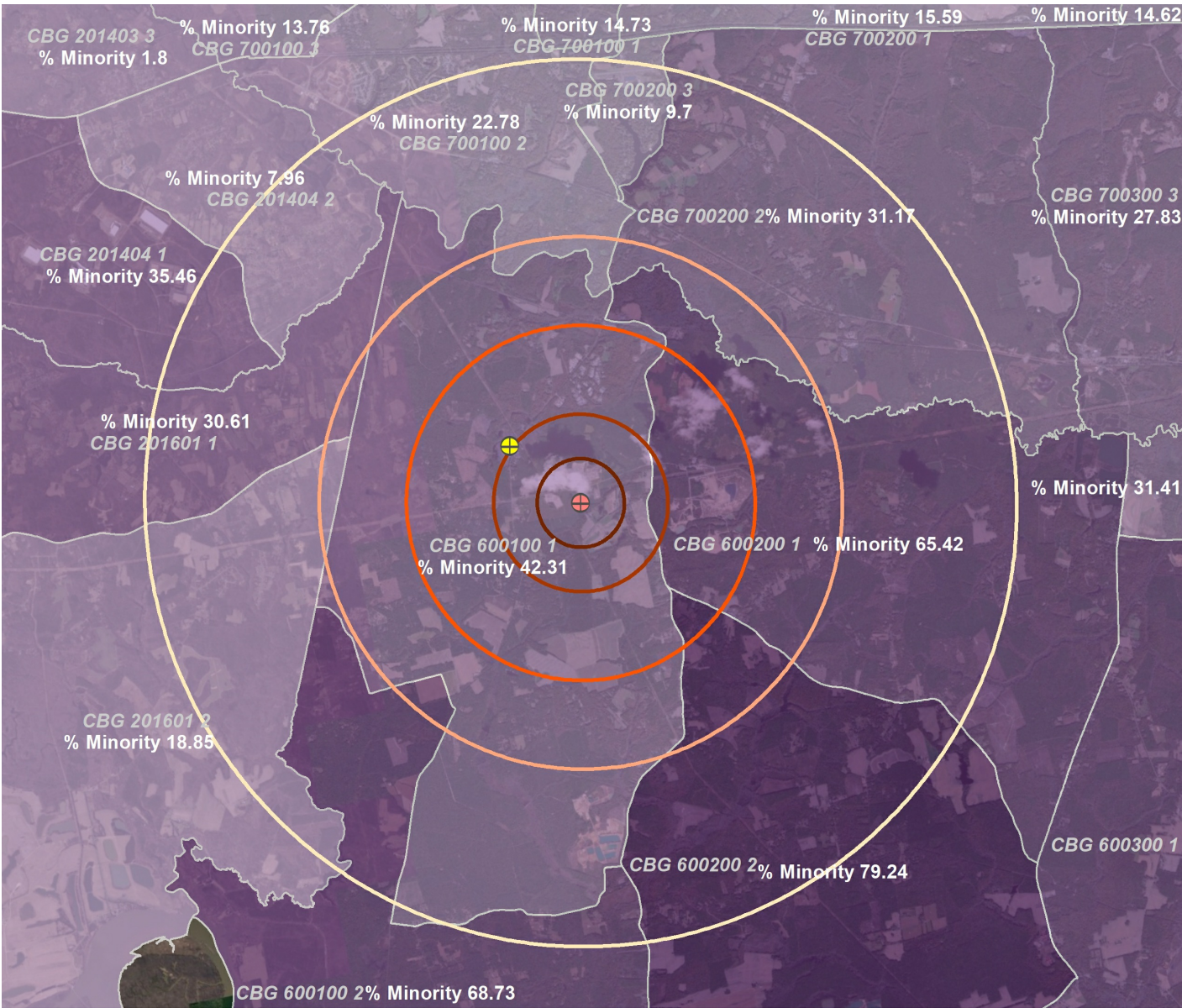
Census Block Group	% Minority	% Poverty	Proximity Intersection Distances (Miles)	Eligibility
600100 - 1	42.31	8.88	.5,1,2,3,5	No
600200 - 1	65.42	13.91	1,2,3,5	Yes - Minority + Poverty
600200 - 2	79.24	11.69	2,3,5	Yes - Minority
600100 - 2	68.73	26.14	3,5	Yes - Minority + Poverty
201601 - 2	18.85	1.92	3,5	No
201601 - 1	30.61	6.27	3,5	No
700100 - 2	22.78	1.96	3,5	No
700200 - 2	31.17	6.15	3,5	No
700200 - 3	9.7	8.4	5	No
201404 - 1	35.46	20.85	5	Yes - Poverty
201404 - 2	7.96	5.55	5	No

On the issue of population density, again the current application is generally silent with little analysis. The only exception is the following declaration designed to narrowly contextualize the applicant's air modeling as 'conservative' relative to population density:

...the proposed Project site is located in a more rural area within a population density of 40 pop/mi² as compared to the location of the CO monitor, which has a population density in Henrico County of 1,313 pop/mi².

Here the applicant utilizes adjacent Henrico County with a much higher population density than the project county Charles City. However, this is not a particularly meaningful comparison beyond highly aggregated considerations as it does little to shed light on the distribution of population within the analysis proximities. There are two alternative approaches available to address this issue. The first is simple geometrically weighted apportionment of *Total Population per census tract*. The second approach utilizes known address point locations as a proxy for human habitation. We would expect to see similar trends across both approaches; and a more suitable, precise method beyond an aggregated county to county comparison as utilized by the applicant for the narrow purpose of emission modeling.

The results of the two approaches are available as both maps and tables located pages 7 and 8. Generally, both approaches find population density to be similar outwards to the 10 mile proximity (population density for Virginia in aggregate is 122 persons per Sq. mile); thereafter the geography gives way to decidedly urban population densities found primarily in Richmond, Virginia.

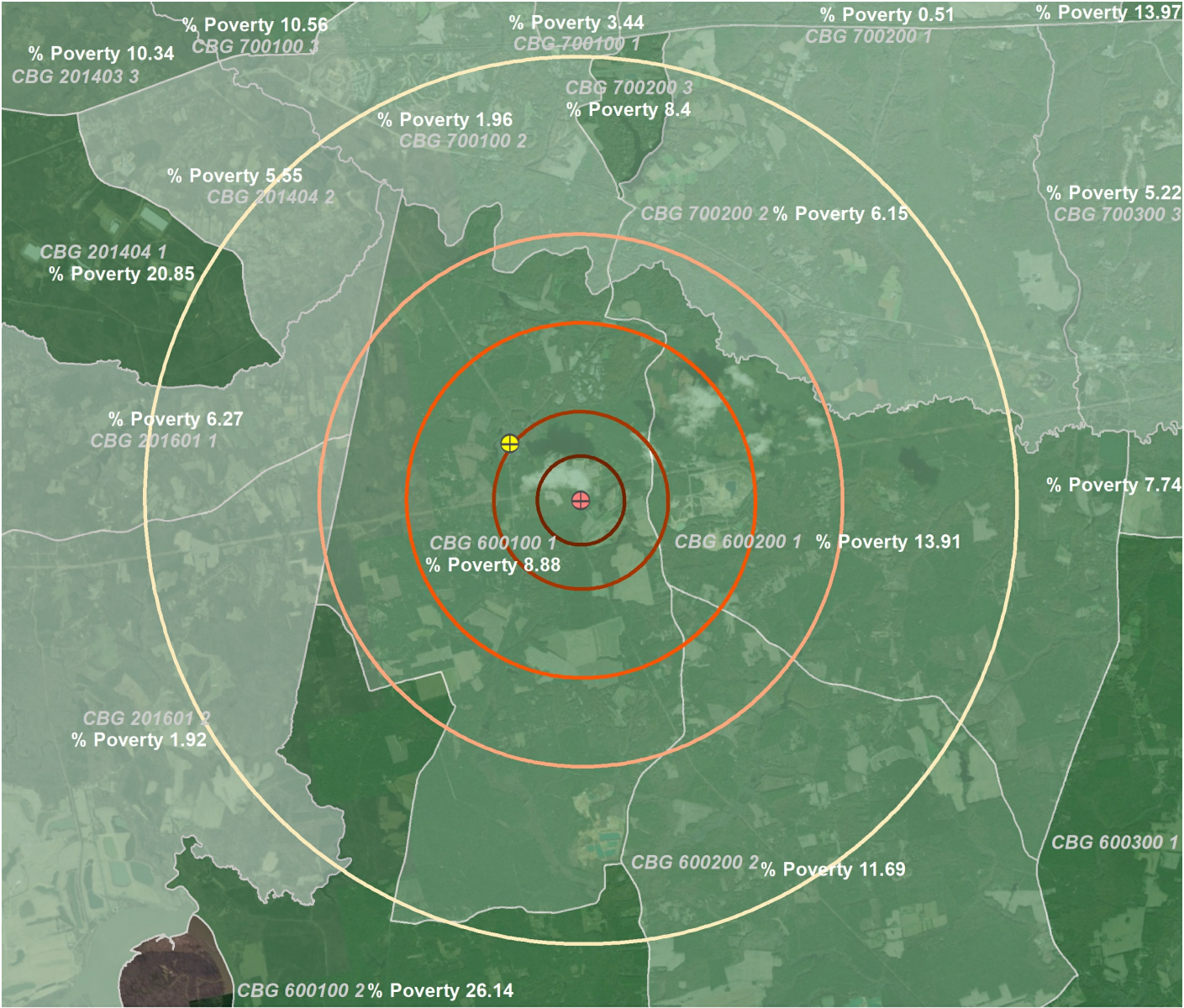


Chickahominy Power Station | Demographic Analysis
Minority Populations - % Minority per Census Block Group

- Proposed | Modeled Chickahominy Power Plant
- C4GT Facility

Proximity Distances (Miles)










.5	0.0% - 23.7%
1	23.7% - 46.5%
2	46.5% - 72.8%
3	72.8% - 100%
5	



Chickahominy Power Station | Demographic Analysis
Poverty Populations - % Poverty per Census Block Group

- Proposed | Modeled Chickahominy Power Plant
- C4GT Facility

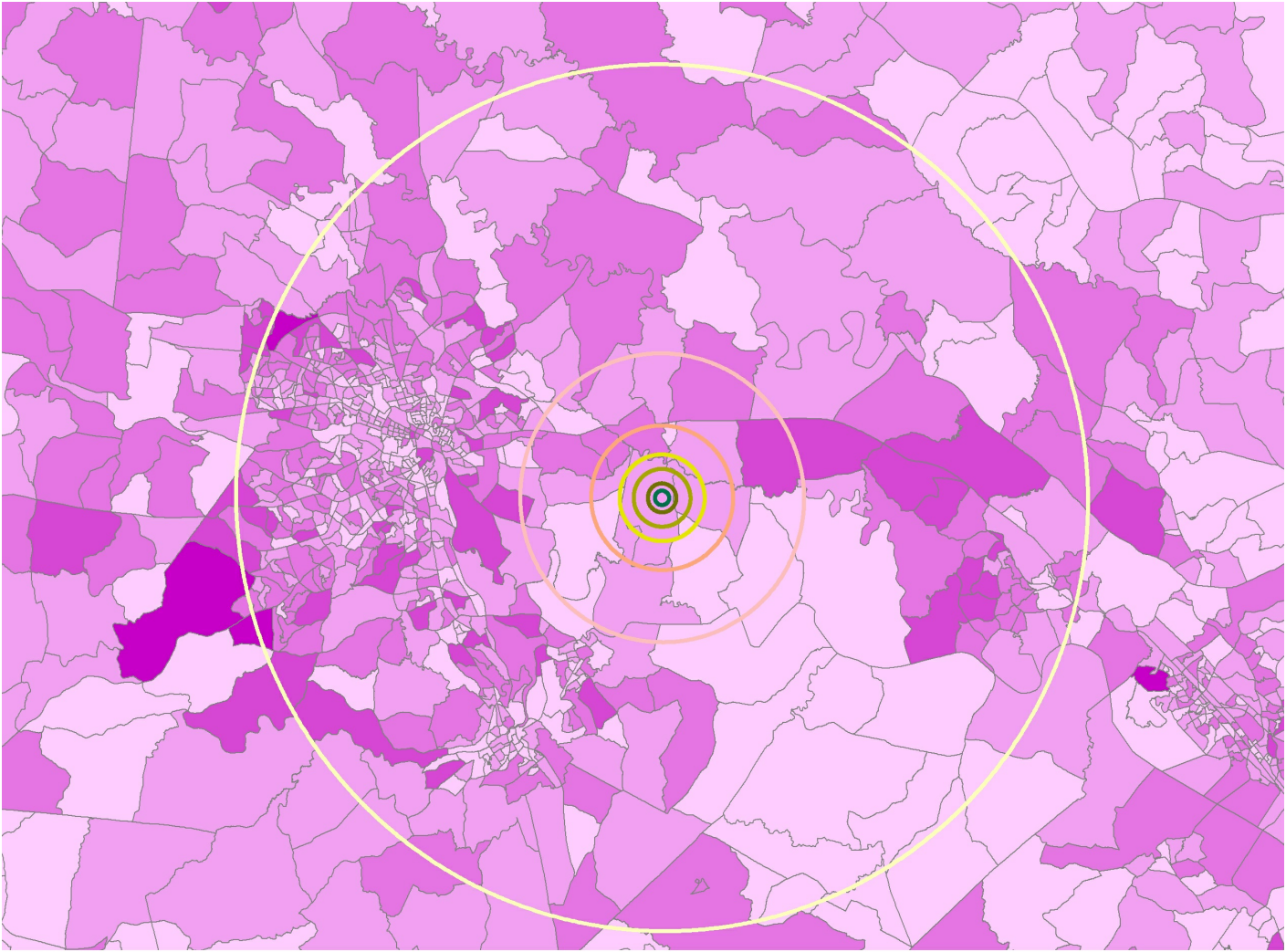
Proximity Distances (Miles)

	.5	% Poverty
	1	
	2	
	3	
	5	
	0% - 7.5%	
	7.5% - 18.5%	
	18.5% - 34.9%	
	34.9% - 63.7%	



Source: ACS, 2012-2016, table B170001





Chickahominy Power Station | Population Density Analysis

Proximities (Miles) Total Population | Census Tracts

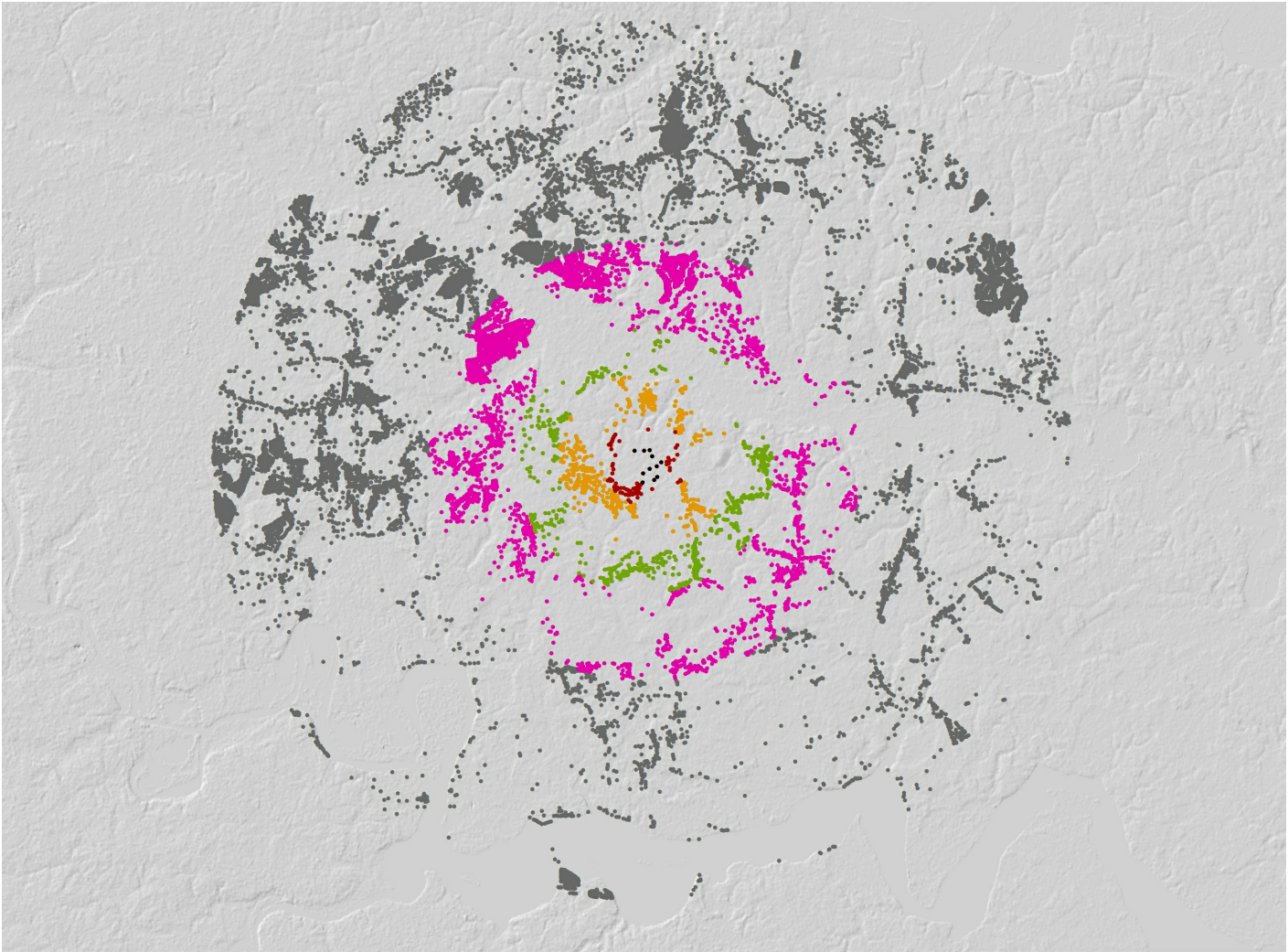
- .5
- 1
- 2
- 3
- 5
- 10
- 30

- 0 - 1148
- 1149 - 1964
- 1965 - 3078
- 3079 - 5389
- 5390 - 15283



Source: US Census, ACS 2012-16

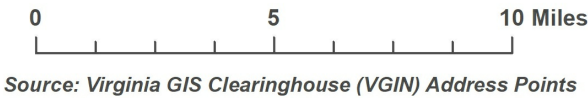




Chickahominy Power Station | Address Point Density

Address Locations per Proximity (Miles)

- .5
- 1
- 2
- 3
- 5
- 10



Source: Virginia GIS Clearinghouse (VGIN) Address Points

Population Densities per Project Proximities | Simple Weighted Apportionment Method:

Proximity Distance	Absolute Population	Persons per Sq. Mile
.5	54	68.7
1	217	69.0
2	856	68.1
3	2009	71.0
5	8275	105.36
10	30378	96.6
30	1194040	422.3

Address Density per Project Proximities:

Proximity Distance	Absolute Address Count	Addresses per Sq. Mile
.5	11	14
1	90	28
2	533	42
3	1069	37
5	4571	58
10	17670	56
30	536867	189

Environment Justice and indigenous tribal lands analysis:

From the previous section, it has been clearly demonstrated that EJ eligible tracts exist in close proximity to the project, and should be included in a further EJ analysis by the applicant and VDEQ. Further, while the project geography is decidedly rural based on two analysis methods found in the previous section, this fact alone does not relieve applicants and regulatory agencies from federal and state EJ policies and guidance. Further, even as the EJ threshold is crossed warranting further and enhanced EJ engagement, an additional EJ issue based on geographic intersection is that of indigenous tribal lands. The project's namesake is indeed related to immediate geography - historical land belonging to the [Chickahominy Tribe](#). While not a federally defined geography, the US Census designates this area as a State Designated Tribal Statistical Area (SDTSA) defined as follows:

[SDTSAs] encompass a compact and contiguous area that contains a concentration of individuals who identify with a state recognized American Indian tribe and in which there is structured or organized tribal activity.

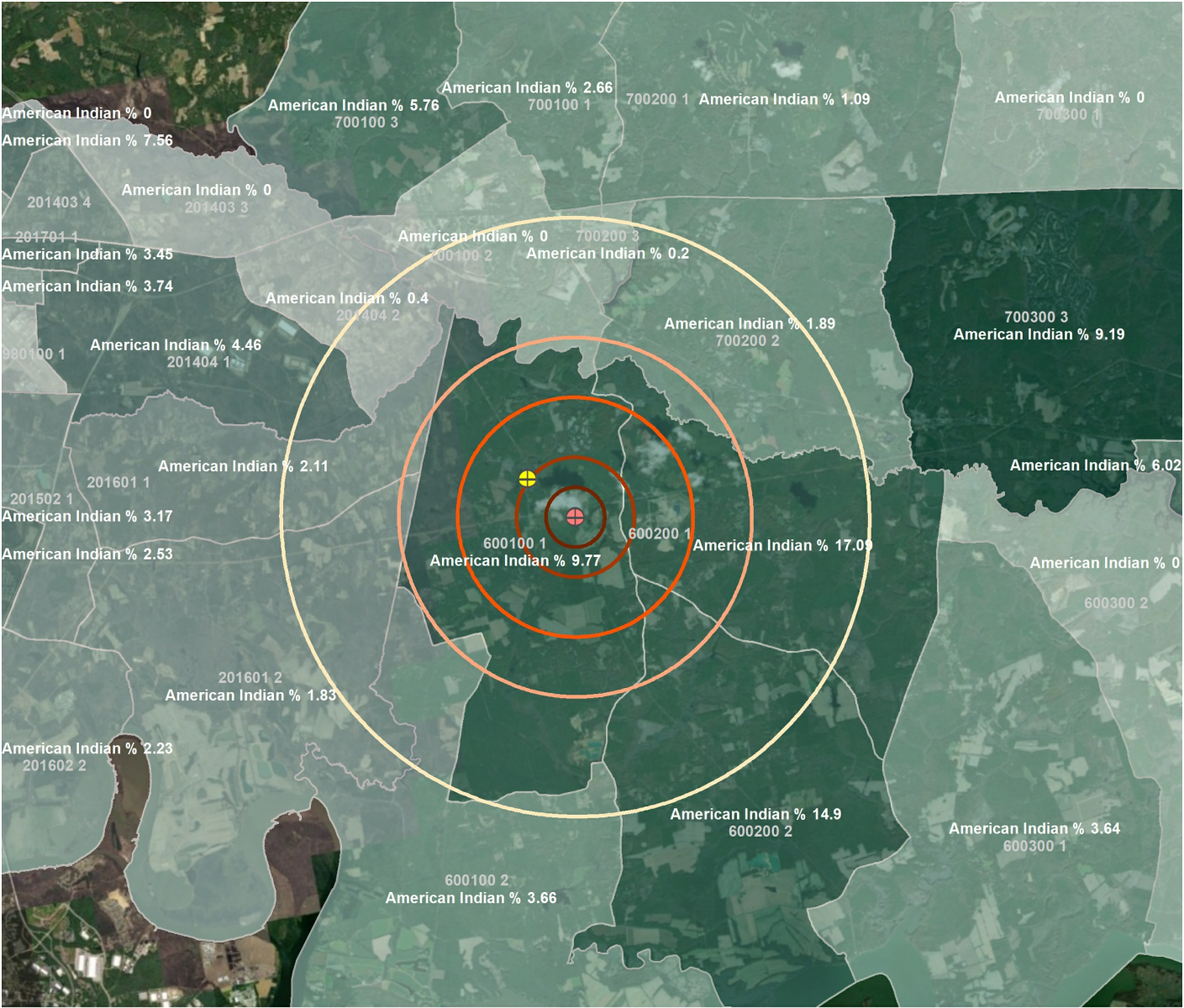
In review of the ACS 2013-17 statistical representation of the Chickahominy SDTSA in Virginia, the total population is found to be **3,649 persons**. Recognized by Virginia State in 1983, the Chickahominy tribal geography does not possess clearly defined boundaries, rather individuals belonging to the tribe may be inferred from US Census data via both the SDTSA designation and through specific ACS census tables. In this particular analysis, *ACS table B02010*, vintage 2012-16, utilizes the following thematic focus to isolate likely Chickahominy tribe members in CBGs that intersect and surround the project site:

People who are American Indian or Alaska Native alone or in combination with one or more other races

In the summary table to follow and mapping on page 11, spatial distribution of American Indians throughout the various project proximities is evident. Here concentrations are significant throughout .5 to 5 mile proximities reinforcing EJ eligibility of Chickahominy tribe members and well as members of other indigenous and minority communities relative to the proposed project. While the Chickahominy tribe itself has no defined geographic unit as utilized in spatial analysis, the results of this census analysis are reinforced by the [Native Land mapping project](#) which features a generalized spatial representation of Chickahominy tribal lands in Charles City County.

Census Block Groups Intersections for % American Indian variable:

Census Block Group	% American Indian	Absolute Count	Proximity Intersection Distances (Miles)
600100 - 1	9.77	160	.5,1,2,3,5
600200 - 1	17.09	210	1,2,3,5
600200 - 2	14.90	160	2,3,5
600100 - 2	3.66	45	3,5
201601 - 2	1.83	20	3,5
201601 - 1	2.11	40	3,5
700100 - 2	0	0	3,5
700200 - 2	1.89	27	3,5
700200 - 3	0.20	2	5
201404 - 1	4.46	88	5
201404 - 2	0.40	9	5



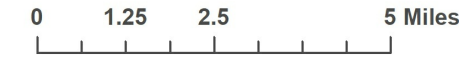
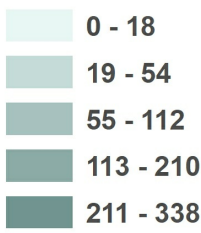
Chickahominy Power Station | Tribal Populations
% American Indian per Census Block Group

- ⊕ Proposed | Modeled Chickahominy Power Plant
- ⊕ C4GT Facility

Proximity Distances (Miles)



American Indian | Count



Source: ACS, Table B02010, Vintage 2012-16



Spatial dispersion and concentration of modeled impacts:

While previous report sections have addressed populations in proximity to the proposed project, this final section turns to modeled emission impacts derived from a series of [AERMOD](#) model runs for various criteria pollutants typical of gas-fired plants and infrastructure. The following table lists pollutants which have been modeled; additionally denoted in the table is a Yes/No determination of a concentrations reaching 'Significant Impact Levels' (SILs). In the case of a positive concentration, the turbine option that produced the concentration is noted, which for this particular project is always both.

Pollutant	Averaging Period	SIL	Turbine Option
PM10	24-hour	Yes	GE 7HA.02 + MHPS M501JAC
PM2.5	24-hour	No	NA
PM2.5	Annual	No	NA
NO2	1-hour	Yes	GE 7HA.02 + MHPS M501JAC
NO2	Annual	Yes	GE 7HA.02 + MHPS M501JAC
CO	1-hour	No	NA
CO	8-hour	No	NA
SO2	1-hour	No	NA
SO2	3-hour	No	NA
SO2	24-hour	No	NA
SO2	Annual	No	NA

With concentrations reaching SILs, the applicant is required to conduct further model runs incorporating background sources. Specifically for the Chickahominy project, the SILs requiring further modeling are:

The modeling results for both turbine options indicate that the Project will have significant modeling impacts for NO2 (1-hour and annual) and PM10 (24-hour).

The resulting isopleths for each SILs concentration are shown on page 14 for both turbine combinations (extracted from *Appendix G - Air Quality Impacts - Contour Map*). It is clear from these cartographic outputs that concentrations will emanate outwards to the C4GT facility and across terrain shared by the C4GT facility; but like the larger report, these maps are quiet on the issue of both the extreme proximity and combined spatial distribution and concentration of both emission source points across all modeling scenarios. Further, while the application alludes to an *Appendix F* where background concentration sources would be listed, the currently posting shows *Appendix F* as a blank page.

While the applicant is required to maintain aggregated NAAQS and PSD Increment air quality thresholds - and claims to have shown ostensible capacity to do so via the modeling runs - that does not answer the critical question of significant adverse impacts to EJ populations in close proximity to both the C4GT and Chickahominy projects. In review of the project application and [public comments](#), the concerns of this report are consistent with those of multiple parties - specifically the Sierra Club and Appalachian Voices, Et al. A few quotes from both comment letters demonstrate the significant, consistent concern over not only the extreme proximity of two very large gas-fired plants, but their potential to deliver adverse and disproportionate impacts on local EJ populations:

VDEQ recently proposed a permit for another gas-fired combined cycle power plant, the C4GT Charles City Combined Cycle Power Plant, which is planned to be located within a mile of Chickahominy. Given the proximity of these sources, it is imperative that the Charles City Power Plant's emissions be included in the cumulative modeling done for Chickahominy.

Clearly, the cumulative modeling for Chickahominy understated emissions from the C4GT combustion turbine generators and thus the cumulative NO2 analysis is significantly flawed, especially given how close these plants will be to each other.

...the cumulative NO2 NAAQS analysis is significantly flawed due to the failure to adequately model allowable short-term average NOX emissions from the nearby C4GT plant and the failure to model concurrent worst case NOX emissions from both the C4GT plant and Chickahominy.

Further, the cumulative NAAQS analysis is deficient because Chickahominy Power failed to adequately model the nearby planned C4GT/Novi Energy combined cycle power plant.

The use of a proper background 1-hour NO₂ concentration is extremely important given how close the modeling of the Chickahominy plant when equipped with GE 7HA.02 turbines is to the 1-hour NO₂ NAAQS. Chickahominy Power reported a modeled concentration of 1-hour NO₂ of the plant with GE 7HGA.02 turbines of 180.23 µg/m³, which is almost 96% of the 1-hour NO₂ NAAQS of 188 µg/m³.⁸⁴

The proposed Chickahominy and C4GT facilities would be sited within one mile of each other, creating further potential for a localized pollution hotspot.

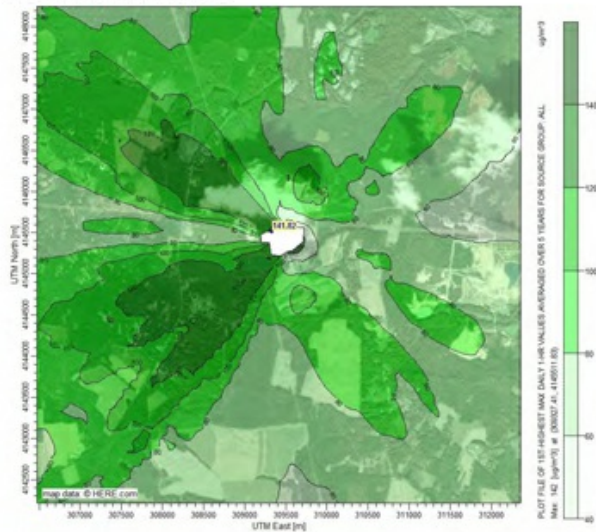
However, this analysis does not discuss the impact of the combined emissions within smaller geographic units or within the 1, 2, and 5 mile radii analyzed in the EJSCREEN.

No other analysis of the combined air pollution from the C4GT and Chickahominy facilities has been provided.

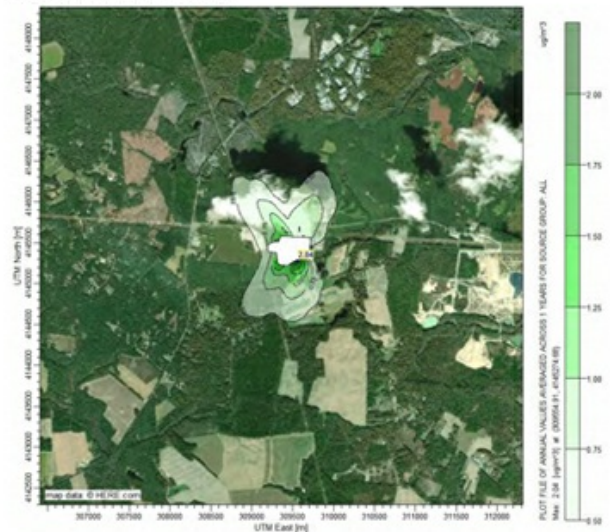
Concluding Remarks:

The size, proximity characteristics and current modeling deficiencies of the proposed Chickahominy Power Station application relative to EJ communities and indigenous peoples is grounds for a fuller, extended consideration of project impacts. Through this report, not only have the locations of EJ eligible geographies and peoples been ascertained in close proximity to the project, but the anomalous proximity of both the C4GT and Chickahominy projects within the national field of existing gas-fired projects has been determined. In the current application there is no quantification or spatial analysis of adverse and disproportionate air quality impacts on localized populations within the nearest project proximities. While the project may have been analyzed for aggregated regional standards as set forth by NAAQS and PSD, current modeling deficiencies - especially for the NO₂ criteria pollutant - point to an incomplete application that does not fully inform nor protect the public from localized adverse and disproportionate impacts. As such, the current application is incomplete and deficient, requiring fuller EJ impact analyses as well as the correction of modeling defects.

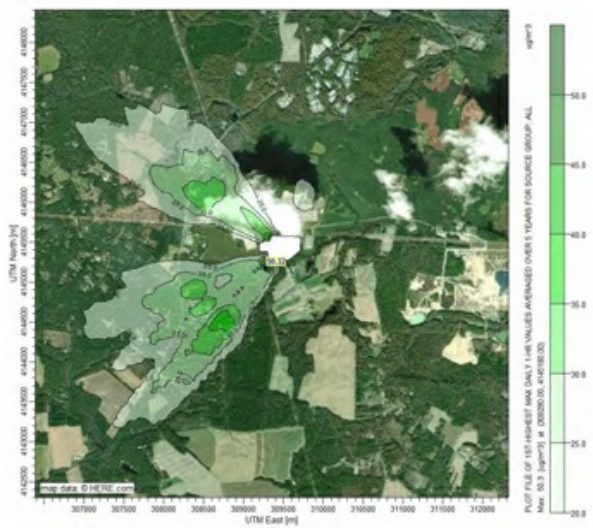
GE - 1 Hour NO2 SIL



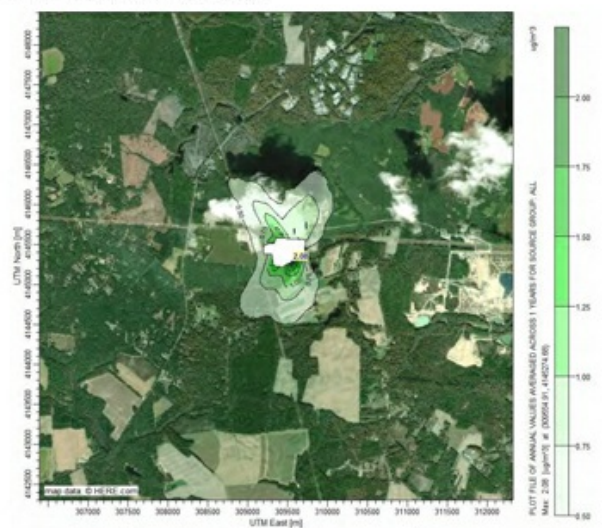
GE Annual NO2 SIL



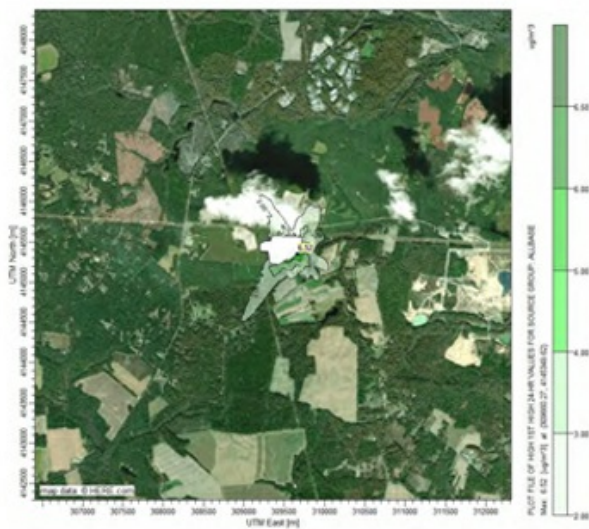
MHPS 1 - Hour NO2 SIL



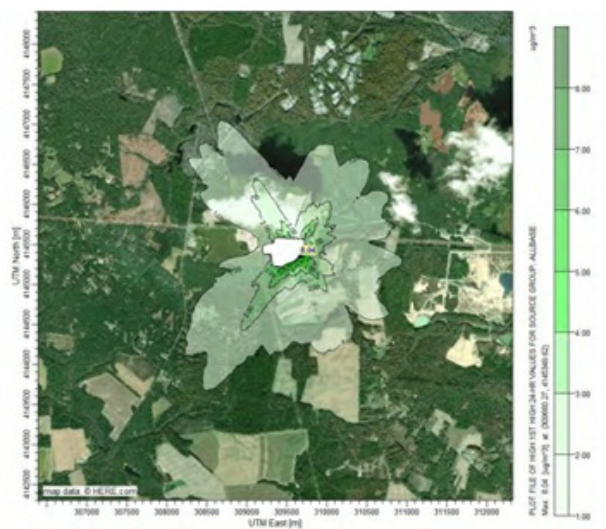
MHPS Annual NO2 SIL



GE 24 - Hour PM10 SIL



MHPS 24 - Hour PM10 SIL



References:

- [DEQ Chickahominy Power Plant Application Page](#)
- [VDEQ project page](#)
- [Virginia Mercury | Author Sarah Vogelsson](#)
- [EPA Project Comments](#)
- [Applicant Engineering Report](#)
- [Chickahominy tribe VDEQ presentation](#)
- [Native Land Territories- Chickahominy](#)
- [C4GT Project Overview](#)