Population Exposure Estimates in Proximity to Nuclear Power Plants: Locations and Country-Level Aggregates Data Release

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This document outlines the basic methodology used to construct the Population Exposure Estimates in Proximity to Nuclear Power Plants, Locations and Country-Level Aggregates data sets. Please see the disclaimer and use restrictions at the end of the document, as well as the recommended citations below. We appreciate feedback regarding these data sets, such as suggestions, discovery of errors, difficulties in using the data, and format preferences.

1) Recommended Citation for Locations:

Center for International Earth Science Information Network (CIESIN)/Columbia University. 2015. Population Exposure Estimates in Proximity to Nuclear Power Plants: Locations. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://dx.doi.org/10.7927/H4WH2MXH. Accessed DAY MONTH YEAR

2) Recommended Citation for Country-Level Aggregates:

Center for International Earth Science Information Network (CIESIN)/Columbia University. 2015. Population Exposure Estimates in Proximity to Nuclear Power Plants: Country-Level Aggregates. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://dx.doi.org/10.7927/H41834D6. Accessed DAY MONTH YEAR

Purpose:

Locations: To provide a global data set of point locations and attributes describing nuclear power plants and reactors.

Country-Level Aggregates: To provide estimates of total, urban and rural population, and land area in proximity to nuclear power plants.

Abstracts:

The Population Exposure Estimates in Proximity to Nuclear Power Plants, Locations data set combines information from a global data set developed by Declan Butler of Nature News and the Power Reactor Information System (PRIS), an up-to-date database of nuclear reactors maintained by the International Atomic Energy Agency (IAEA). The locations of nuclear reactors around the world are represented as point features associated with reactor specification and performance history attributes as of March 2012. The data set provides the location and attributes in Shapefile and CSV formats.

The Population Exposure Estimates in Proximity to Nuclear Power Plants, Country-Level Aggregates data set consists of country-level estimates of total, urban and rural population, and land area that are in proximity to a nuclear power plant. This data set was created using a global data set of point locations of nuclear power plants, with buffer zones at 30km, 75km, 150km, 300km, 600km, and 1200km, along with the Global Population Count Grid Time Series Estimates to estimate the population within each buffer zone for the years 1990, 2000, and 2010. Global Rural-Urban Mapping Project, Version 1 (GRUMPv1) Land and Geographic Unit Area Grids were used to estimate land area within each buffer zone. The GRUMPv1 Urban Extents Grid was used to further delineate population and land area estimates within urban and rural areas. All grids used for population, land area, and urban mask, were of 1 km (30 arc-second) resolution. The data set provides the country-level estimates in .XLS format.

Methods:

To estimate the size of populations living near nuclear power plants, the Locations global data set was created. The data set consists of two layers of information, power plants and reactors. The power plant locations are represented as point features associated with population exposure estimates for the years 1990, 2000, and 2010 within six buffer zones. The locations of nuclear reactors around the world are represented as point features associated with eighteen reactor specification and performance history attributes.

IAEA does not provide latitudes and longitudes for the power plants or reactors; the majority of the coordinates were obtained by performing a database merge with the older United Nations Environment Programme-Global Resource Information Database (UNEP-GRID) reactor database, which contains geographic coordinates on reactors up to the year 2000. The remaining entries that lacked

coordinate data were manually geocoded using coordinates collected from Wikipedia and their map extension GeoHack.

The status of reactors is an attribute included in this data release and is coded operational, under construction, long-term shutdown or permanently shutdown. Only plants that have at least one operational reactor have been included for the analysis. Additional attributes describe the type of reactor and the amount of power produced each year, creating a time series of nuclear energy generated around the world as of March, 2012. There are 276 power plants and 643 reactors, complete with the attributes found in Tables 1a and 1b.

The Country-Level Aggregates spreadsheet consists of country-level estimates of total, urban and rural population, and land area that are in proximity to a nuclear power plant. In order to obtain these values, zonal statistics were generated combining the buffer zones, population, land area and time.

First, using the Population Count Grid Time Series Estimates and Land and Geographic Unit Area Grids, the total values were calculated for population and land area per country for 1990, 2000, and 2010.

Vector buffers were created at 30km, 75km, 150km, 300km, 600km and 1200km away from the nuclear reactors. The polygon feature classes were then converted to raster grids. The grids were then combined with the GRUMPv1 National Administrative Boundaries such that each buffer zone is associated with their appropriate country.

Zonal statistics were calculated by country for population and area within each buffer zone for the years 1990, 2000 and 2010. The field names containing these values are in the form "pop+year_+distance" and are described in Table 2.

Once the total summations were obtained for each country, the data was then delineated by rural and urban areas, using the Urban Extents Grid. Zonal statistics were calculated using these masks for the same series of buffers and years. The field names containing these values are in the form "pop+year_+distance+_urban" or "pop+year_+distance+_rural" and are described in Table 2.

All grids used for population, land area, and urban mask were of 1 km (30 arc-second) resolution. The data set provides the country-level estimates in XLS format.

Downloads:

Locations:

This data set may be downloaded at http://sedac.ciesin.columbia.edu/data/set/energy-pop-exposure-nuclear-plants-locations

Data are available as a compressed zipfile of a Shapefile and Comma Separated Values (.CSV). Downloaded files need to be uncompressed in a single folder using either WinZip (Windows file

compression utility) or similar application before they can be opened by GIS software. Users should expect an increase in the size of downloaded data after decompression.

The data are stored in geographic coordinates of decimal degrees based on the World Geodetic System spheroid of 1984 (WGS84).

Country-Level Aggregates:

This data set may be downloaded at
http://sedac.ciesin.columbia.edu/data/set/energy-pop-exposure-nuclear-plants-country

The data are available as an Excel spreadsheet (.XLS).

Table 1a. Locations (Power Plants with Population Exposure)

Field Name	Attribute	Description
Region	Region	Region
Country	Country	Country
Plant	Plant Site Name	Name of nuclear plant
NumReactor	Number of Reactors	Number of active reactors at the plant
Latitude	Latitude	Decimal Degrees
Longitude	Longitude	Decimal Degrees
Population Exposure		
p90_1200	Population Exposure	1990 Population exposed at 1200km
p00_1200	Population Exposure	2000 Population exposed at 1200km
p10_1200	Population Exposure	2010 Population exposed at 1200km
p90u_1200	Urban Population Exposure	1990 Urban Population exposed at 1200km
p00u_1200	Urban Population Exposure	2000 Urban Population exposed at 1200km
p10u_1200	Urban Population Exposure	2010 Urban Population exposed at 1200km
p90r_1200	Rural Population Exposure	1990 Rural Population exposed at 1200km
p00r_1200	Rural Population Exposure	2000 Rural Population exposed at 1200km
p10r_1200	Rural Population Exposure	2010 Rural Population exposed at 1200km
p90_600	Population Exposure	1990 Population exposed at 600km
p00_600	Population Exposure	2000 Population exposed at 600km
p10_600	Population Exposure	2010 Population exposed at 600km
p90u_600	Urban Population Exposure	1990 Urban Population exposed at 600km
p00u_600	Urban Population Exposure	2000 Urban Population exposed at 600km
p10u_600	Urban Population Exposure	2010 Urban Population exposed at 600km
p90r_600	Rural Population Exposure	1990 Rural Population exposed at 600km
p00r_600	Rural Population Exposure	2000 Rural Population exposed at 600km
p10r_600	Rural Population Exposure	2010 Rural Population exposed at 600km
p90_300	Population Exposure	1990 Population exposed at 300km
p00_300	Population Exposure	2000 Population exposed at 300km
p10_300	Population Exposure	2010 Population exposed at 300km
p90u_300	Urban Population Exposure	1990 Urban Population exposed at 300km
p00u_300	Urban Population Exposure	2000 Urban Population exposed at 300km
p10u_300	Urban Population Exposure	2010 Urban Population exposed at 300km
p90r_300	Rural Population Exposure	1990 Rural Population exposed at 300km
p00r_300	Rural Population Exposure	2000 Rural Population exposed at 300km
p10r_300	Rural Population Exposure	2010 Rural Population exposed at 300km
p90_150	Population Exposure	1990 Population exposed at 150km
p00_150	Population Exposure	2000 Population exposed at 150km
p10_150	Population Exposure	2010 Population exposed at 150km
p90u_150	Urban Population Exposure	1990 Urban Population exposed at 150km
p00u_150	Urban Population Exposure	2000 Urban Population exposed at 150km
p10u_150	Urban Population Exposure	2010 Urban Population exposed at 150km
p90r_150	Rural Population Exposure	1990 Rural Population exposed at 150km

p00r_150	Rural Population Exposure	2000 Rural Population exposed at 150km
p10r_150	Rural Population Exposure	2010 Rural Population exposed at 150km
p90_75	Population Exposure	1990 Population exposed at 75km
p00_75	Population Exposure	2000 Population exposed at 75km
p10_75	Population Exposure	2010 Population exposed at 75km
p90u_75	Urban Population Exposure	1990 Urban Population exposed at 75km
p00u_75	Urban Population Exposure	2000 Urban Population exposed at 75km
p10u_75	Urban Population Exposure	2010 Urban Population exposed at 75km
p90r_75	Rural Population Exposure	1990 Rural Population exposed at 75km
p00r_75	Rural Population Exposure	2000 Rural Population exposed at 75km
p10r_75	Rural Population Exposure	2010 Rural Population exposed at 75km
p90_30	Population Exposure	1990 Population exposed at 30km
p00_30	Population Exposure	2000 Population exposed at 30km
p10_30	Population Exposure	2010 Population exposed at 30km
p90u_30	Urban Population Exposure	1990 Urban Population exposed at 30km
p00u_30	Urban Population Exposure	2000 Urban Population exposed at 30km
p10u_30	Urban Population Exposure	2010 Urban Population exposed at 30km
p90r_30	Rural Population Exposure	1990 Rural Population exposed at 30km
p00r_30	Rural Population Exposure	2000 Rural Population exposed at 30km
p10r_30	Rural Population Exposure	2010 Rural Population exposed at 30km

Table 1b. Locations (Power Plant Reactors with Power Output)

Field Name	Attribute	Description
Region	Region	Region
Country	Country	Country
Reactor	Reactor Unit Name	Name of reactor
Plant	Plant Site Name	Name of nuclear plant
Plant_Loc	Proximity to Water	Location of nuclear plant in reference to bodies of water (seacoast, inland near a river, inland near a lake)
Latitude	Latitude	Decimal Degrees
Longitude	Longitude	Decimal Degrees
Status	Reactor Status	Operational, Under construction, Long-term shutdown, Permanently shut down
Type	Reactor Type	Type of reactor (i.e. Pressurized Water Reactor, Boiling Water Reactor)
Start_Date	Start Date	Date in which construction began
Year_Built	Year Built	Year in which construction began
Grid_Date	Grid Date	Date when the reactor is first connected to the electrical grid for the supply of power.
Shutdown	Shutdown Date	Permanent Shutdown Date
Wikipedia	Location Reference	Webpage containing information about reactor or plant

Photo	Photo Reference	Webpage containing photo of the reactor or plant
PhotoCred	Photo Reference Credit	Photo Reference Credit
NumReactor	Number of Reactors	Number of active reactors at the plant
Ref_ + YYYY	Power + YYYY	Power produced by a reactor in YYYY, from 1956 to 2012
Totalpower	Total Power 2012	Power produced by a power plant in year 2012

Table 2. Country-Level Aggregates.

Field Name	Description
ISO	ISO country codes (ISO 3166-1 alpha-3)
Country	Country name
Total population and land area by country	
Total_area_90	Sum of land area in 1990
Total_area_00	Sum of land area in 2000
Total_area_10	Sum of land area in 2010
Total_pop_90	Sum of population in 1990
Total_pop_00	Sum of population in 2000
Total_pop_10	Sum of population in 2010
Total population by urban-rural	
Pop90_urb	Sum of urban population in 1990
Pop00_urb	Sum of urban population in 2000
Pop10_urb	Sum of urban population in 2010
Pop90_rur	Sum of rural population in 1990
Pop00_rur	Sum of rural population in 2000
Pop10_rur	Sum of rural population in 2010
Total population by buffer zone	
Pop90_1200km	Sum of 1990 population 1200km from a reactor
Pop00_1200km	Sum of 2000 population 1200km from a reactor
Pop10_1200km	Sum of 2010 population 1200km from a reactor
Pop90_600km	Sum of 1990 population 600km from a reactor
Pop00_600km	Sum of 2000 population 600km from a reactor
Pop10_600km	Sum of 2010 population 600km from a reactor
Pop90_300km	Sum of 1990 population 300km from a reactor
Pop00_300km	Sum of 2000 population 300km from a reactor
Pop10_300km	Sum of 2010 population 300km from a reactor
Pop90_150km	Sum of 1990 population 150km from a reactor
Pop00_150km	Sum of 2000 population 150km from a reactor
Pop10_150km	Sum of 2010 population 150km from a reactor
Pop90_75km	Sum of 1990 population 75km from a reactor
Pop00_75km	Sum of 2000 population 75km from a reactor
Pop10_75km	Sum of 2010 population 75km from a reactor
Pop90_30km	Sum of 1990 population 30km from a reactor

Pop00_30km	Sum of 2000 population 30km from a reactor
Pop10_30km	Sum of 2010 population 30km from a reactor
Total urban population by buffer zone	
Pop90_1200km_urban	Sum of 1990 urban population 1200km from a reactor
Pop00_1200km_urban	Sum of 2000 urban population 1200km from a reactor
Pop10_1200km_urban	Sum of 2010 urban population 1200km from a reactor
Pop90_600km_urban	Sum of 1990 urban population 600km from a reactor
Pop00_600km_urban	Sum of 2000 urban population 600km from a reactor
Pop10_600km_urban	Sum of 2010 urban population 600km from a reactor
Pop90_300km_urban	Sum of 1990 urban population 300km from a reactor
Pop00_300km_urban	Sum of 2000 urban population 300km from a reactor
Pop10_300km_urban	Sum of 2010 urban population 300km from a reactor
Pop90_150km_urban	Sum of 1990 urban population 150km from a reactor
Pop00_150km_urban	Sum of 2000 urban population 150km from a reactor
Pop10_150km_urban	Sum of 2010 urban population 150km from a reactor
Pop90_75km_urban	Sum of 1990 urban population 75km from a reactor
Pop00_75km_urban	Sum of 2000 urban population 75km from a reactor
Pop10_75km_urban	Sum of 2010 urban population 75km from a reactor
Pop90_30km_urban	Sum of 1990 urban population 30km from a reactor
Pop00_30km_urban	Sum of 2000 urban population 30km from a reactor
Pop10_30km_urban	Sum of 2010 urban population 30km from a reactor
Total rural population by buffer zone	
Pop90_1200km_rural	Sum of 1990 rural population 1200km from a reactor
Pop00_1200km_rural	Sum of 2000 rural population 1200km from a reactor
Pop10_1200km_rural	Sum of 2010 rural population 1200km from a reactor
Pop90_600km_rural	Sum of 1990 rural population 600km from a reactor
Pop00_600km_rural	Sum of 2000 rural population 600km from a reactor
Pop10_600km_rural	Sum of 2010 rural population 600km from a reactor
Pop90_300km_rural	Sum of 1990 rural population 300km from a reactor
Pop00_300km_rural	Sum of 2000 rural population 300km from a reactor
Pop10_300km_rural	Sum of 2010 rural population 300km from a reactor
Pop90_150km_rural	Sum of 1990 rural population 150km from a reactor
Pop00_150km_rural	Sum of 2000 rural population 150km from a reactor
Pop10_150km_rural	Sum of 2010 rural population 150km from a reactor
Pop90_75km_rural	Sum of 1990 rural population 75km from a reactor
Pop00_75km_rural	Sum of 2000 rural population 75km from a reactor
Pop10_75km_rural	Sum of 2010 rural population 75km from a reactor
Pop90_30km_rural	Sum of 1990 rural population 30km from a reactor
Pop00_30km_rural	Sum of 2000 rural population 30km from a reactor
Pop10_30km_rural	Sum of 2010 rural population 30km from a reactor
Total land area by buffer zone	
Area90_1200km	Sum of 1990 land area 1200km from a reactor
Area 00_1200km	Sum of 2000 land area 1200km from a reactor

Area 10_1200km	Sum of 2010 land area 1200km from a reactor
Area 90_600km	Sum of 1990 land area 600km from a reactor
Area 00_600km	Sum of 2000 land area 600km from a reactor
Area 10_600km	Sum of 2010 land area 600km from a reactor
Area 90_300km	Sum of 1990 land area 300km from a reactor
Area 00_300km	Sum of 2000 land area 300km from a reactor
Area 10_300km	Sum of 2010 land area 300km from a reactor
Area 90_150km	Sum of 1990 land area 150km from a reactor
Area 00_150km	Sum of 2000 land area 150km from a reactor
Area 10_150km	Sum of 2010 land area 150km from a reactor
Area 90_75km	Sum of 1990 land area 75km from a reactor
Area 00_75km	Sum of 2000 land area 75km from a reactor
Area 10_75km	Sum of 2010 land area 75km from a reactor
Area 90_30km	Sum of 1990 land area 30km from a reactor
Area 00_30km	Sum of 2000 land area 30km from a reactor
Area 10_30km	Sum of 2010 land area 30km from a reactor
Total urban area by buffer zone	
Area 90_ 1200km_urban	Sum of 1990 urban land area 1200km from a reactor
Area 00_ 1200km_urban	Sum of 2000 urban land area 1200km from a reactor
Area 10_ 1200km_urban	Sum of 2010 urban land area 1200km from a reactor
Area 90_ 600km_urban	Sum of 1990 urban land area 600km from a reactor
Area 00_ 600km_urban	Sum of 2000 urban land area 600km from a reactor
Area 10_ 600km_urban	Sum of 2010 urban land area 600km from a reactor
Area 90_ 300km_urban	Sum of 1990 urban land area 300km from a reactor
Area 00_ 300km_urban	Sum of 2000 urban land area 300km from a reactor
Area 10_ 300km_urban	Sum of 2010 urban land area 300km from a reactor
Area 90_ 150km_urban	Sum of 1990 urban land area 150km from a reactor
Area 00_ 150km_urban	Sum of 2000 urban land area 150km from a reactor
Area 10_ 150km_urban	Sum of 2010 urban land area 150km from a reactor
Area 90_ 75km_urban	Sum of 1990 urban land area 75km from a reactor
Area 00 _75km_urban	Sum of 2000 urban land area 75km from a reactor
Area 10 _75km_urban	Sum of 2010 urban land area 75km from a reactor
Area 90_ 30km_urban	Sum of 1990 urban land area 30km from a reactor
Area 00_ 30km_urban	Sum of 2000 urban land area 30km from a reactor
Area 10_ 30km_urban	Sum of 2010 urban land area 30km from a reactor
Total rural area by buffer zone	
Area 90_ 1200km_rural	Sum of 1990 rural land area 1200km from a reactor
Area 00 _1200km_rural	Sum of 2000 rural land area 1200km from a reactor
Area 10_ 1200km_rural	Sum of 2010 rural land area 1200km from a reactor
Area 90_ 600km_rural	Sum of 1990 rural land area 600km from a reactor
Area 00_ 600km_rural	Sum of 2000 rural land area 600km from a reactor
Area 10_ 600km_rural	Sum of 2010 rural land area 600km from a reactor
Area 90_ 300km_rural	Sum of 1990 rural land area 300km from a reactor
Area 00_ 300km_rural	Sum of 2000 rural land area 300km from a reactor
Area 10_ 300km_rural	Sum of 2010 rural land area 300km from a reactor
Area 90_ 150km_rural	Sum of 1990 rural land area 150km from a reactor

Area 00_ 150km_rural	Sum of 2000 rural land area 150km from a reactor
Area 10_ 150km_rural	Sum of 2010 rural land area 150km from a reactor
Area 90_ 75km_rural	Sum of 1990 rural land area 75km from a reactor
Area 00_ 75km_rural	Sum of 2000 rural land area 75km from a reactor
Area 10_ 75km_rural	Sum of 2010 rural land area 75km from a reactor
Area 90_ 30km_rural	Sum of 1990 rural land area 30km from a reactor
Area 00_30km_rural	Sum of 2000 rural land area 30km from a reactor
Area 10_30km_rural	Sum of 2010 rural land area 30km from a reactor