CodPop: Computer Code for Defining Population Centers around NPP sites

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1. Background

An applicant for a reactor license is required by 10 CFR Part 100, corresponding rule to the MEST Notice No. 2008-7, to designate a population center distance, defined as the distance from the nuclear reactor center to the nearest boundary of a densely populated center containing more than about 25,000 residents. The population center distance must be at least one-third times the distance to the outer boundary of the low population zone (LPZ)[1]. The outer boundary of a population center shall be determined upon consideration of population distribution, not controlled by political boundaries (NARA, 1997).

This paper presents a computer code, developed from a short term basic research program of Korea Institute of Nuclear Safety in 2008, for analyzing population distributions and defining outer boundary of a population center around a nuclear power plant (Lee et al, 2008).

2. Features of CodPop

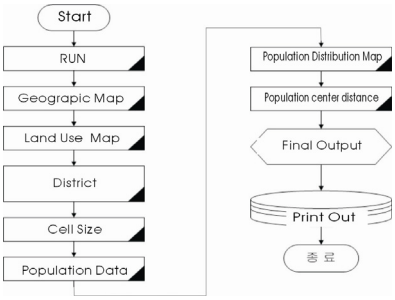
CodPop is a GIS-based computer program developed to provide a tool for defining an outer boundary to each characteristic cluster of densely populated areas scattered around nuclear power plant site (NPP) and for verifying population centers as the result. A Population Center defined by CodPop is a cluster of adjacent densely-populated areas or cells ($\geq$ 500 person/km^2, Korean average population density) containing more than 25,000 residents (IAEA, 1980; NARA, 1997).

Main features of CodPop are as follows:

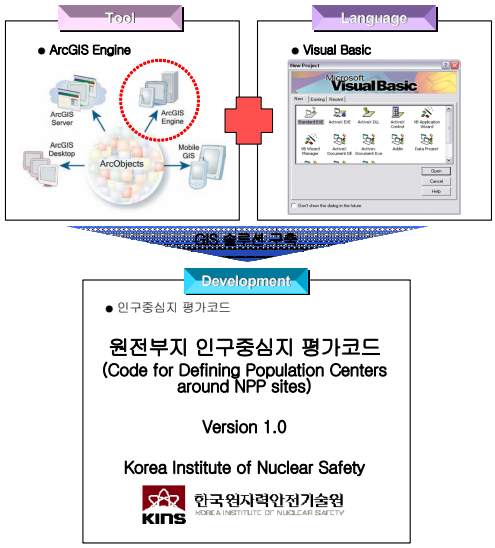
1. A GIS-based population and population density distribution map representing recent population data and land use types.
2. Data input, data processing, map editing and output (maps & tables) in one simple process.
3. Analysis with various resolutions (50m to 1km)
4. Use of customized standard district maps.

[1] A low population zone of such size that an individual located at any point on its outer boundary who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a total radiation dose to the whole body in excess of 25 rem or a total radiation dose in excess of 300 rem to the thyroid from iodine exposure (NARA, 1997).

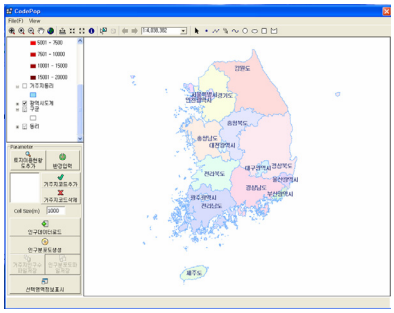
2.1 Main job process



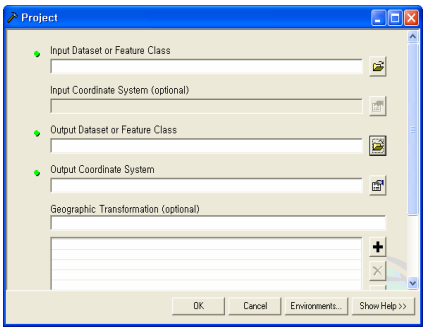
2.2 Basic Operation Environment of CodPop



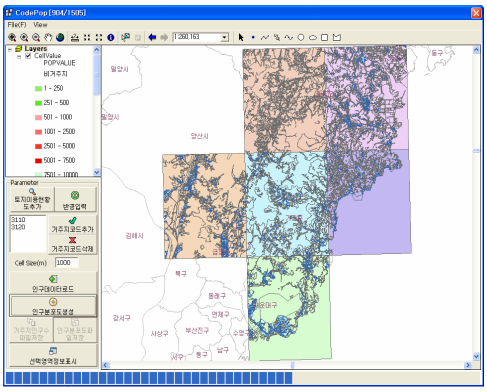
2.3 Main View of CodPop



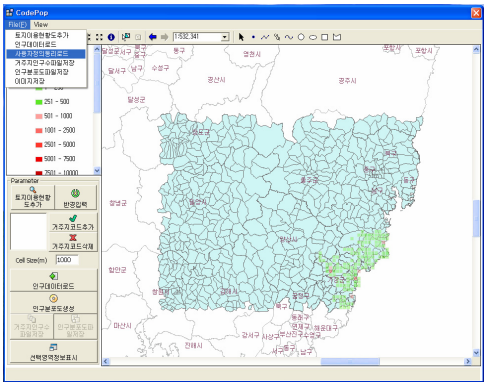
2.4 Input 1: project window

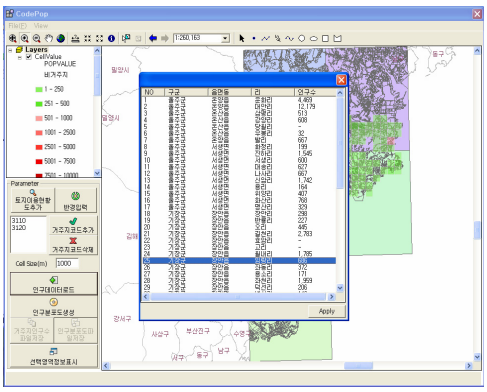


2.5 Input 2: land use types & geography

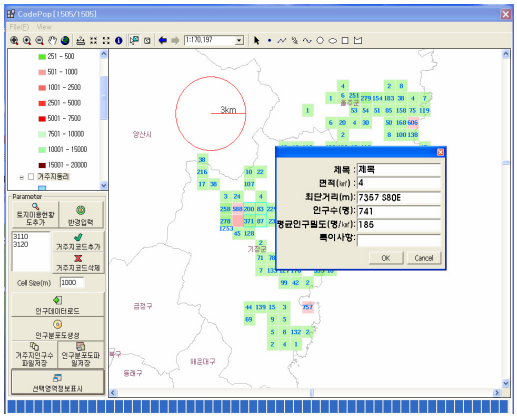


2.6 Input 3: political boundaries & populations





2.7 Output: population distribution map & population center properties



3. Concluding remarks

CodPop would provide a useful tool for evaluation of the population distribution characteristics and population centers for future nuclear power plant sites in Korea and overseas.

References

[1] IAEA, 1980, "Site Selection and Evaluation for NPPs with respect to Population Distribution," SS-50-SG-S4.

[2] IAEA, 2002, "Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants," NS-G-3.2.

[3] IAEA, 2003, "Site Evaluation for Nuclear Installations," NS-R-3.

[4] NARA, 1997, "Reactor Site Criteria," Code of Federal Regulation 10, Energy: part 100, published by the Office of the Federal Register National Archives and Records Administration, U.S.A., 472-487.

[5] US NRC, 1979, "Demographic Statistics Pertaining to Nuclear Power Reactor Sites," NUREG-0348.

[6] US NRC, 1998, “General Site Suitability Criteria for Nuclear Power Stations,” Regulatory Guide 4.7.

[7] US NRC, 2007, "2.1.3 Population Distribution," Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, NUREG-0800.

[8] Lee, H., Im, C.-B. and Hyun, S.-K., 2008, “Development of Regulatory Guide: Population Center”, KINS/RR-641, 79p.