Environmental Assessment for Final Rule, 10 CFR 435, "Energy Efficiency Standards for New Federal Low-Rise Residential Buildings" Baseline Standards Update (DOE/EA-1926)

May 2013

Abbreviations and Acronyms

ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
Btu	British thermal unit
CFC	chlorofluoro-carbon
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CPSC	Consumer Product Safety Commission
DOE	U.S. Department of Energy
EO	Executive Order
EA	environmental assessment
ECPA	Energy Conservation and Production Act
EPA	U.S. Environmental Protection Agency
EUI	Energy use intensity, kBtu/ft2-yr
FR	Federal Register
GHG	greenhouse gas
HFC	hydro fluorocarbon
Hg	mercury
HVAC	heating, ventilation, and air-conditioning
ICC	International Code Council
IECC	International Energy Conservation Code
IPCC	Intergovernmental Panel on Climate Change
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act of 1969
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NRC	U.S. Nuclear Regulatory Commission
PFC	perfluorocarbon
PM	particulate matter
SF_6	sulfur hexafluoride
SOx	sulfur oxide gases
$6SO_2$	sulfur dioxide
UNEP	United Nations Environment Program
U.S.C.	United States Code
VOC	volatile organic compounds

1.0 Purpose and Need for Agency Action

This Environmental Assessment (EA) complies with the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4321 et seq., the implementing regulations of the Council on Environmental Quality (40 Code of Federal Regulations [CFR] Parts 1500–1508), and the U.S. Department of Energy's (DOE's) regulations for implementing NEPA (10 CFR Part 1021).

Section 305 of the Energy Conservation and Production Act (ECPA), requires DOE to establish building energy efficiency standards for all new Federal buildings (42 U.S.C. 6834). Section 305(a)(1) requires standards that contain energy-efficiency measures that are technologically feasible and economically justified but, at a minimum, require the subject buildings to meet the energy saving specifications in the applicable voluntary consensus energy code specified in section 305(a)(2) (42 U.S.C. 6834(a)(1) and (2)).

Section 305 of ECPA also requires that "Not later than 1 year after the date of approval of each subsequent revision of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) Standard or the International Energy Conservation Code (IECC), as appropriate, the Secretary shall determine, based on the cost-effectiveness of the requirements under the amendment, whether the revised standards established under this paragraph should be updated to reflect the amendment" (42 U.S.C. 6834(a)(3)(B)).

DOE's Final Rule is the result of DOE's determination that the revised standards for new Federal low-rise residential buildings should be updated to reflect the amendments made in the 2012 IECC based on the cost-effectiveness of the latest private sector standards and DOE's determination as to the energy-efficiency improvements of the 2012 version of the IECC as required by Title III of ECPA, which establishes requirements for the Building Energy Efficiency Standards Program (42 U.S.C. 6831, et seq.). DOE issued a final determination on the International Code Council's 2012 IECC on May 17, 2012. (77 Fed. Reg. 29322.) This EA examines the potential environmental impacts of the Final Rule.

2.0 The Final Rule and Alternatives

The potential environmental impacts that would result from implementing the Final Rule for new Federal low-rise residential buildings (three stories or less in height above ground) were examined by comparing the Final Rule with the minimum that Federal agencies must achieve under the existing 10 CFR 435, which is based on IECC 2009.

2.1 The Proposed Action – The Final Rule

The proposed action is the Final Rule, which would update the baseline standard to the 2012 IECC. If adopted, the Final Rule would set new energy efficiency requirements for building envelope; heating, ventilation, and air-conditioning (HVAC) systems; and domestic water-heating systems.

2.2 "No-Action" Alternative– The 2009 IECC

The no-action alternative is defined as the continued use of the 2009 IECC, as required by the current 10 CFR Part 435. This standard sets the minimum level of energy savings that Federal agencies must achieve under the existing Federal low-rise residential building standard.

3.0 Description of the Affected Environment

The Final Rule contains requirements that could have some environmental impacts on building habitability (indoor environment) and the outdoor environment.

3.1 Indoor Air

Energy efficiency codes can potentially affect indoor air quality, either adversely or beneficially. The primary indoor air emissions that can adversely affect human health in typical commercial and residential buildings are particulate matter, carbon monoxide (CO), carbon dioxide (CO_2), nitrogen dioxide (NO_2), radon, formaldehyde, volatile organic compounds, and biological contaminants.

The Final Rule potentially impacts both ventilation and infiltration of fresh air from the outdoors for Federal low-rise residential buildings. See Section 5.1 Building Habitability (Indoor Air) Impacts for a more detailed discussion. DOE does not expect the net impact on indoor air quality to be adverse.

Requirements in energy-efficiency codes have the potential to impact internally generated indoor emissions by changing the materials used within the buildings. Codes can also address fossil fuel-burning equipment, which has the potential to introduce combustion exhaust pollutants to the indoor air if not properly installed and vented to the outdoors. Various pollutants can be emitted continuously or intermittently released within commercial and residential buildings. These emissions can originate from furnishings within a building (e.g., carpet, furniture), from building materials (e.g., insulation material, particle board), from the ground (e.g., radon), from the building occupants' indoor activities (e.g., tobacco smoking, painting), or from the improper functioning of mechanical equipment (e.g., fossil-fuel appliances). Potential combustion emissions include CO, CO_2, nitrogen oxides, and sulfur dioxide (SO_2). Fossil-fuel-burning equipment (including gas stoves/ovens) and tobacco smoke, are the main sources of combustion products. In addition, sources from outside the building (particularly vehicle exhaust) can be drawn into the building. The Final Rule is not expected to change the concentration of pollutants rates from indoor sources of air pollution compared to the no-action alternative.

Table 1 summarizes the principal indoor air emissions that can potentially be of concern within buildings.

Table 1. Indoor Air Emissions

Pollutant	Health Impacts	Sources
Particulate Matter	Lung cancer, bronchitis, and respiratory infections. Eye, nose, and throat irritations.	Fossil fuel combustion, dust, smoking.
Carbon Monoxide	CO is an odorless and colorless gas that is an asphyxiate and disrupts oxygen transport. At high concentration levels, CO causes loss of consciousness and death.	Unvented kerosene and gas space heaters; leaking chimneys and furnaces; back drafting from furnaces, gas water heaters, wood stoves, and fireplaces; gas stoves; and automobile exhaust from attached garages.
Carbon Dioxide	An excessive concentration of CO_2 triggers increased breathing to maintain the proper exchange of oxygen and CO_2. Concentrations above 3 percent can cause headaches, dizziness, and nausea. Concentrations above 6 percent to 8 percent can cause death (NRC 1981).	Sources include human respiration, tobacco smoking, gas stoves, and gas ovens.
Nitrogen Dioxide	NO_2 acts mainly as an irritant, affecting the eyes, nose, throat, and respiratory tract. Extremely high-dose exposure to NO_2 (as in a building fire) may result in pulmonary edema and diffuse lung injury. Continued exposure to high NO_2 levels can lead to acute bronchitis (EPA 1994).	Sources include kerosene heaters, gas stoves, ovens, and tobacco smoke.
Radon	Radon decay products in breathed air can deposit and stay in the lungs, sometimes contributing to lung cancer. The National Academy of Sciences (NAS) estimates that 15,400 to 21,800 people in the United States die from lung cancer attributable to radon, although the number could be as low as 3,000 or as high as 32,000 (NAS 1998). A large majority of the deaths happen to cigarette smokers. Radon is much less of a concern in commercial buildings than in residential buildings as these buildings usually have mechanical ventilation and occupants are typically not in the buildings as many hours a week as they are in their homes.	Radon is a radioactive gas that occurs in nature. The greatest single source of radon is from the soil. It can be found in soils and rocks containing uranium, granite, shale, phosphate, and pitchblende (Moffat 1997).
Formaldehyde	The EPA has classified formaldehyde as a "probable human carcinogen" (EPA 1989). In low concentration levels, formaldehyde irritates the eyes and mucous membranes of the nose and throat (NRC 1981). Formaldehyde can cause watery eyes; burning sensations in the eyes, nose, and throat; nausea; coughing; chest tightness; wheezing; skin rashes; and allergic reactions (CPSC 1997).	Various pressed-wood products can emit formaldehyde, including particle board, plywood, pressed wood, paneling, some carpeting and backing, some furniture and dyed materials, urea-formaldehyde insulating foam, and pressed textiles (CPSC 1997). Cigarette smoke also produces formaldehyde.
Volatile Organic Compounds (VOCs)	VOCs can cause a wide variety of health problems. Some examples of potential health effects include increased cancer risks, depression of the central nervous system, irritation to the eyes and respiratory tract, and liver and kidney damage. Some evidence exists that VOCs can provoke some of the symptoms typical of sick-	VOCs contain carbon and exist as vapors at room temperatures. Over 900 VOCs have been identified in indoor air (EPA 1991). Formaldehyde is one type of VOC. Many products give off VOCs as

Pollutant	Health Impacts	Sources
	building syndrome and cause severe reactions for individuals who appear to demonstrate multiple chemical sensitivities (EPA 1991).	they dry, cure, set, or otherwise age (Moffat 1997).
Biological Contaminants	Biological agents in indoor air are known to cause three types of human disease: infections, where pathogens invade human tissue; hypersensitivity diseases, where specific activation of the immune system causes diseases; and toxicosis, where biologically produced chemical toxins cause direct toxic effects (EPA 1994). Evidence is available showing that some episodes of sick-building syndrome may be related to microbial contamination of buildings (EPA 1994).	Sources include outdoor air and human occupants who shed viruses and bacteria, animal occupants (insects and other arthropods, mammals) that shed allergens, and indoor surfaces and water reservoirs such as humidifiers where fungi and bacteria can grow (EPA 1994).

3.2 Outdoor Air

For all new Federal low-rise buildings covered by the rule, the Final Rule is expected to reduce energy consumption and thereby lower air emissions caused by the consumption of fossil fuels. The EA addresses the air impacts associated with the projected reduction in energy consumption.

3.2.1 Air Emissions

The analysis considers several air pollutants, which may take the form of solid particles (i.e., particulates or particulate matter), liquid droplets, or gases.[1]

Carbon Dioxide. Carbon dioxide (CO_2) is of interest because of its classification as a greenhouse gas (GHG). GHGs trap the sun's radiation inside the Earth's atmosphere and either occur naturally in the atmosphere or result from human activities. Naturally occurring GHGs include water vapor, CO_2, methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Human activities, however, add to the levels of most of these naturally occurring gases. For example, CO_2 is emitted to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), wood, and organic products are burned. In 2007, over 90 percent of anthropogenic (i.e., human-made) CO_2 emissions resulted from burning fossil fuels (EPA 2009).

Concentrations of CO_2 in the atmosphere are naturally regulated by numerous processes, collectively known as the "carbon cycle." The movement of carbon between the atmosphere and the land and oceans is dominated by natural processes, such as plant photosynthesis. While these natural processes can absorb some of the anthropogenic CO_2 emissions, billions of metric tons are added to the atmosphere annually. In the United States, in 2007, CO_2 emissions from electricity generation accounted for 39 percent of total U.S. GHG emissions.[2]

[1] More information on air pollution characteristics and regulations is available on EPA's website at http://www.epa.gov/gateway/learn/airpollution.html.

[2] IPCC Working Group 3, Table TS2.

Nitrogen Oxides. Nitrogen oxides**,** or NO_x, is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO_2), along with particles in the air can often be seen as a reddish-brown layer over many urban areas. NO_2 is the specific form of NO_x reported in this document. NO_x is one of the main ingredients involved in the formation of ground-level ozone, which can trigger serious respiratory problems. It can contribute to the formation of acid rain, and can impair visibility in areas such as national parks. NO_x also contributes to the formation of fine particles that can impair human health (EPA 2011b).

Nitrogen oxides form when fossil fuel is burned at high temperatures, as in a combustion process. The primary manmade sources of NO_x are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fossil fuels. NO_x can also be formed naturally. Electric utilities account for about 22 percent of NO_x emissions in the United States.

Mercury. Coal-fired power plants emit mercury (Hg) found in coal during the burning process. Coal-fired power plants are the largest remaining source of human-generated Hg emissions in the United States (EPA 2011c). U.S. coal-fired power plants emit Hg in three different forms: oxidized Hg (likely to deposit within the United States); elemental Hg, which can travel thousands of miles before depositing to land and water; and atmospheric Hg that is in particulate form. Atmospheric Hg is then deposited on land, lakes, rivers, and estuaries through rain, snow, and dry deposition. Once there, it can transform into methylmercury and accumulate in fish tissue through bioaccumulation.

Americans are exposed to methylmercury primarily by eating contaminated fish. Because the developing fetus is the most sensitive to the toxic effects of methylmercury, women of childbearing age are regarded as the population of greatest concern. Children exposed to methylmercury before birth may be at increased risk of poor performance on neurobehavioral tasks, such as those measuring attention, fine motor function, language skills, visual-spatial abilities, and verbal memory (Trasande et al. 2006).

Sulfur Dioxide. Sulfur dioxide, or SO_2, belongs to the family of sulfur oxide gases (SO_x). These gases dissolve easily in water. Sulfur is prevalent in all raw materials, including crude oil, coal, and ore that contains common metals like aluminum, copper, zinc, lead, and iron. SO_x gases are formed when fuel containing sulfur, such as coal and oil, is burned, and when gasoline is extracted from oil, or metals are extracted from ore. SO_2 dissolves in water vapor to form acid, and interacts with other gases and particles in the air to form sulfates and other products that can be harmful to people and their environment (EPA 2011a).

Methane Methane emissions in the U.S. are from three categories of sources, each accounting for about one-third of total emissions: (1) energy sources, (2) emissions from domestic livestock, and (3) decomposition of solid waste in landfills. The methane emitted from energy sources occurs primarily during the production and processing of natural gas, coal, and oil; not in the actual use (combustion) of these fuels. Methane is the primary ingredient in natural gas, and production, processing, storage, and transmission of natural gas account for 56 percent of the energy source emissions (or 25 percent of all methane emissions). (DOE 2005)

Carbon Monoxide The main source of CO is the incomplete burning of fossil fuels such as gasoline. Exhaust from 'highway vehicles' contributes about 55 percent of all CO emissions. The CO produced from energy use related to buildings is 3 percent of all emissions, but most of this is from the burning of wood in residential buildings, which should not be impacted by these rules. 0.7% of CO emissions come from fuel combustion for electrical generation by utilities. (EPA 2007)

Particulate Matter. Particulate matter (PM), also known as particle pollution, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic compounds, metals, and soil or dust particles.

PM impacts are of concern due to exposures that can impact human health. Particle pollution - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can enter deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including: increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example; decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death in people with heart or lung disease.

With regard to the impact of standards on particulate matter (PM), the great majority of ambient PM associated with power plants is in the form of secondary sulfates, which are produced at a significant distance from power plants by complex atmospheric chemical reactions that often involve the gaseous emissions of power plants, mainly SO_2 and NO_x. The benefits that DOE estimates for reductions in SO_2 and NO_x emissions resulting from standards are in fact primarily related to the health benefits of reduced indirect PM. Power plants may also emit particulates from the smoke stack, which are known as direct PM emissions. Because these highly complex chemical reactions produce PM comprised of different constituents from different sources, EPA does not distinguish direct PM emissions from power plants from the secondary sulfate particulates in its ambient air quality requirements, PM monitoring of ambient air quality, or PM emissions inventories.

3.2.2 Global Climate Change

Climate change has evolved into a matter of global concern because it is expected to have widespread, adverse effects on natural resources and systems. A growing body of evidence points to anthropogenic (human caused) sources of GHGs, such as CO_2, as major contributors to climate change. As concentrations of these gases increase due to human activity, more warming occurs than would happen naturally. Of U.S. GHG emissions, the majority are related to energy consumption, and most of those are carbon dioxide. The United States produced about 18% of the world's total energy-related carbon dioxide in 2010 — the last year for which comparable data are available.

The Final Rule would have a very small but positive impact on U.S. CO2 emissions rate (2,902 metric tons per year decrease). Total U.S. anthropogenic greenhouse gas emissions in 2009 were 5.8 percent below the 2008 total. The decline in total emissions—from 6,983 million metric tons carbon dioxide equivalent ($MMTCO_2e$) in 2008 to 6,576 $MMTCO_2e$ in 2009—was the largest since emissions have been tracked over the 1990-2009 time frame. It was largely the result of a 419-$MMTCO_2e$ drop in carbon dioxide (CO_2) emissions (7.1 percent). EIA 2011

4.0 Calculated Energy Savings

Energy savings for the Final Rule were estimated using the DOE-2 energy simulation software to determine the energy savings. The prototype building used in the energy simulations is intended to approximate a typical new house. The prototype characteristics used were:

- A rectangular two-story house, 30 ft × 40 ft, with 2400 ft^2 of conditioned floor area.
- Window area of 15 percent of the conditioned floor.
- The heating system consisted of a gas furnace and cooling that is via central air conditioning with an air-ducted system. Domestic water heating is assumed to be from natural gas.
- Foundation: Slab-on-grade in southern climates and crawlspace in northern climates.

This analysis included simulations of the 97 locations encompassing all regions and climates in the United States. These results are combined into a weighted national average.

Table 2 shows the national average annual energy savings from the Final Rule compared to the 2009 IECC baseline energy use intensity (EUI). EUI is the energy consumed by a building per square foot per year. The table compares various levels of EUI savings against the "No-Action" baseline, as described in Section 2. Source energy includes energy used at the building site and energy lost in producing and delivering the energy to the site for electricity. The source energy impacts are used to estimate emission reductions.

Table 2. Annual Energy Savings (kBtu/ft^2-year) of Final Rule Compared to No-Action Alternative

Baseline (no-action alternative)	**Final Rule – Code or Standard**	**Site Energy Breakdown**		**Total**	
		Gas EUI (kBtu/ft^2-yr)	**Electric EUI (kBtu/ft^2-yr)**	**Site EUI (kBtu/ft^2-yr)**	**Source EUI (kBtu/ft^2-yr)**
IECC-2009	IECC-2012	6.6	0.4	7.0	7.8
	10% below IECC-2012	8.6	0.9	9.5	11.5
	20% below IECC-2012	10.7	1.4	12.1	15.2
	30% below IECC-2012	12.7	1.9	14.6	18.8
	40% below IECC-2012	14.7	2.5	17.2	22.5
	50% below IECC-2012	16.8	3.0	19.7	26.1

5.0 Environmental Impacts

This section provides the potential environmental impacts that may result from implementing the Final Rule for low-rise residential buildings. The Final Rule is evaluated at the new minimum level, the 2012 IECC, as well as increments of 10 percent increases in energy efficiency, up to 50 percent better than the 2012 IECC. These values are then compared with the no-action alternative, which is the 2009 IECC.

5.1 Building Habitability (Indoor Air) Impacts

Building energy code requirements could influence the concentration levels of indoor air emissions by decreasing the leakage of air through the building envelope (known as infiltration). The Final Rule potentially changes infiltration relative to the no-action alternative. The 2009 IECC requires the building envelope be durably sealed to limit infiltration and goes on to provide a list of openings in the building envelope that must be sealed but does not require any testing to verify proper sealing. The 2012 IECC requires sealing of the building envelope similar to the 2009 IECC but also requires a pressure test of the building to verify that infiltration is at or below a stringent maximum level. DOE expects this testing to result in reduced infiltration in many homes because visual inspection cannot be relied upon to detect small leaks in the building envelope. Lower infiltration has the disadvantage of reducing dilution of air pollutants that may be produced inside the home, though lower infiltration has the advantage of limiting air pollutants from outside the home from entering the home (for example, from a garage).

Mechanical ventilation systems can be used to remove pollutants generated in a home and provide fresh air from the outdoors to the home. The 2009 IECC does not require any mechanical ventilation. The 2012 IECC requires mechanical ventilation systems to be installed in all new homes. Mechanical ventilation requirements in the 2012 IECC are incorporated by reference via the mandatory mechanical ventilation requirements in the 2012 International Residential Code (IRC) or International Mechanical Code (IMC), or with other means of ventilation as approved by the code official. The International Code Council states that the IRC and IMC are designed to protect public health, safety and welfare, and the IECC states that it is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances. Given that the 2012 IECC requires mechanical ventilation in building construction, the mechanical ventilation requirement is based on codes designed to protect public health, safety and welfare, and the 2012 IECC specifies that safety, health or environmental requirements should not be curtailed in meeting the 2012 IECC, DOE does not expect the net impact on indoor air quality to be adverse.

Other than by requiring the installation of a mechanical ventilation system as described above, the Final Rule does not address the potential for indoor air quality-related health problems. The Final Rule addresses buildings as designed and does not impact how a building is operated (e.g., how a ventilation system is controlled) nor does it impact materials (e.g., type of paint used, or if occupants are exposed to fumes from painting) used in the buildings. The Final Rule and the no-action alternative do not have any requirements specifically for radon control or control of other indoor air emissions.

5.2 Outdoor Air

Under all the alternatives, GHG emissions (carbon dioxide, methane, and nitrous oxides) are reduced because more energy efficient buildings consume less fossil fuel, which results in reduced GHG emissions. Table 3 shows the estimated reductions of greenhouse gas emissions resulting from the Final Rule. This is the annual energy savings from one year of Federal construction under the 10-percent, 20-percent, 30-percent, 40-percent, and 50-percent energy savings alternatives

Electricity production ultimately used in Federal residential buildings is assumed to have the same distribution of fuel/energy sources (e.g., coal, nuclear) as overall national electricity production. This distribution was obtained from the Electric Power Annual (DOE 2011). Reductions in CO_2 emissions were calculated by multiplying the total fuel (coal, natural gas, and oil) savings from the Final Rule by emission coefficients for each fuel. The emissions coefficients were calculated using data from the Electric Power Annual (DOE 2011). Reduction in the release of methane attributable to energy use was obtained by scaling the total national emissions by the percentage savings in total national energy use (by fuel type) resulting from the Final Rule.

The amount of Federal residential low-rise construction that must comply with the requirements in the Final Rule is not known, and estimates of future construction vary from 1000 to 5000 Federal housing units per year over the next three years. For the results shown in this EA, DOE estimates that 2000 Federal housing units per year will be constructed.[3] This estimate is based on historical data obtained from the Department of Defense, which constructs the large majority of all Federal housing. Federal construction rates in the future are not known.

Table 3 shows the estimated first-year reduction in emissions.

[3] The total inventory of Federal existing residential housing units is approximately 250,000 units. Assuming older homes are replaced with new homes at an average age of 50 years, long-term annual construction would be 5000 units. Most planned construction of new Federal housing units is for the Department of Defense (approximately 90% of the new Federal housing units), which estimates approximately 1000 new units per year on average over the next few years. Although DOE recognizes that its estimate of new Federal housing units is imprecise, based on the above data and factors, DOE estimates 2000 new Federal housing units per year for the future. DOE believes that actual future new Federal housing units will be closer to 1000 units per year than 5000 units per year and, therefore, has chosen 2000 units as a conservative estimate.

Table 3. Air Emissions Reductions in Metric Tons (Year 1 of Residential Construction)[4]

Baseline (no-action alternative)	Final Rule- Code or Standard	Carbon Dioxide	Nitrogen Oxides	Mercury	Methane
2009 IECC	2012 IECC	2,902	1.1	0.000015	25
	10% below 2012 IECC	4,756	2.4	0.000034	42
	20% below 2012 IECC	6,639	3.8	0.000052	60
	30% below 2012 IECC	8,493	5.1	0.000071	78
	40% below 2012 IECC	10,605	6.7	0.000093	98
	50% below 2012 IECC	12,488	8.1	0.000112	116

As can be seen from Table 3, if new Federal low-rise residential buildings meets the new minimum requirement rather than the existing minimum requirement (2012 IECC vs. 2009 IECC), an estimated 2,902 metric tons of carbon dioxide emission will be eliminated in one year based on the estimated 2000 units of new construction.

Estimated reductions for the cumulative impacts of 30 years of construction[5] (2013 through 2042) and 30 years of energy reduction[6] for each building built during that period are shown in Table 4.

Table 4. Air Emissions Reductions in Metric Tons (30-Years of Residential Construction)[7]

Baseline (no-action alternative)	Final Rule- Code or Standard	Carbon Dioxide	Nitrogen Oxides	Mercury	Methane
2009 IECC	2012 IECC	2,611,500	966	0.01346	22,101
	10% below 2012 IECC	4,280,400	2,174	0.03029	37,996
	20% below 2012 IECC	5,974,900	3,382	0.04712	54,079
	30% below 2012 IECC	7,643,800	4,590	0.06395	69,974
	40% below 2012 IECC	9,544,400	6,040	0.08414	88,298
	50% below 2012 IECC	11,238,800	7,248	0.10097	104,380

[4] Air emission reductions for sulfur dioxide, nitrous oxide, halocarbons, carbon monoxide, particulate matter and lead are negligible.

[5] This analysis follows the practice of the DOE Appliance and Equipment Standards Program in projecting environmental impacts and energy use out to 30 years. Emissions forecasts beyond 30 years are likely to be unreliable.

[6] This second 30-year assumption reflects the expected service life of the new building components subject to the 2012 IECC, namely, windows and envelope measures (including air infiltration (building tightness) requirements).

[7] Air emission reductions for sulfur dioxide, nitrous oxide, halocarbons, carbon monoxide, particulate matter and lead are negligible.

5.3 Environmental Justice and Other Impacts

A consideration of Environmental Justice is made pursuant to Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (59 Fed. Reg. 7629, EO signed Feb. 11, 1994). The Executive Order requires Federal agencies to address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on low-income or minority populations. The Final Rule would not result in any adverse health effects and therefore does not have the potential for disproportionately high and adverse health effects on minorities and low income population.

The Final Rule is not expected to impact any sensitive environmental resources such as wetlands, endangered species, or historic or archaeological sites. There are no aspects of the Final Rule that would be affected by a terrorist act.

6.0 Agencies and Persons Consulted during This Rulemaking

In accordance with CEQ regulations in 40 CFR 1508.9(b), a list of persons/agencies consulted during the development of this rulemaking and environmental assessment is provided below.

DOE and Contractor Staff

US DOE Building Energy Codes Program
- Michael Erbesfeld
- Mohammed Khan

Pacific Northwest National Laboratory (DOE contractor)
- Mark Halverson
- Robert Lucas
- Sriram Somasundaram
- Todd Taylor

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