Green Construction

With

Amvic Insulating Concrete Form Building System

- Reduced emissions. Over the lifetime of an Amvic ICF structure, it will emit or cause to be emitted many tons less carbon particulate matter. Carbon emission reduction is from the reduction in the consumption of fossil fuels to generate heat and electrical power.
- Reduced lifetime fossil fuel consumption – a home built using Amvic ICF for its exterior shell will consume 40-50% less energy for heating and cooling than conventional wood frame structures.

- Concrete structures are extremely durable, effectively a 200 year structure in which the shell will remain structurally sound and intact. When compared to a frame structure, this reduces *future* environmental impact of replacement or major rehabilitation of the structure that will not be required.
- No CFCs, HCFCs or other environmentally harmful materials are used in manufacturing the Amvic forms.
- Less energy is used at the construction site to construct the shell of the structure when compared to either wood or metal frame construction.
- Each Amvic block is made of 70% recycled materials by weight.
- Recycled salvaged steel is used to manufacture the reinforcing steel, or rebar, that is used within the walls. Most of this comes from recycled automobiles.
- Fire retardant in the foam and concrete reduce the probability of fire with consequential environmental damage.
- Concrete uses the most abundant resource on the planet in its composition: gravel aggregate and limestone (Portland cement). These products are not scarce. Mining these products is a low impact extraction, without the negative impact on greenhouse gases and potential global warming that is produced by widespread timber harvesting.
- Recycled components are used in the concrete mix. The concrete mix we specify replaces 20-30% of the Portland cement with "fly ash". Fly ash is a byproduct of burning coal for power and heat, and is extracted from flue gasses. It is an excellent binder in concrete, and is used to replace part of the Portland cement. According to the EPA, *"every ton of coal ash used in concrete to replace Portland cement reduces 0.89 tons of greenhouse gas emissions."* Additionally, without use in concrete, millions of tons of fly ash would end up in landfills with a costly environmental disposal burden.

How can ICFs be used in USGBC's Leadership in Energy and Environmental Design (LEED) program?

LEED was launched in an effort by the United States Green Building Council to develop a "consensus-based, market-driven rating system to accelerate the development and implementation of green building practices." The LEED rating system has five main credit categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. Each category is divided into credits. The program outlines the intent, requirements, technologies, and strategies for meeting each credit. Credits are broken down into individual points. Additional points can be earned for innovation and use of a LEED-accredited professional on the project team. There are five ways ICFs help when using the LEED rating system. They include:

- ICFs optimize energy performance
- Concrete & ICFs contain recycled materials
- Concrete creates sustainable sites
- Concrete is manufactured locally
- Concrete builds durable structures

- Construction site waste is drastically reduced. Concrete for the walls is delivered and used as required with very little waste. With efficient design, the block waste itself can be reduced to less than 1-2%. Conventional construction yields typically 15% or greater waste in the construction of the shell of a house. 65% of the waste entering the nation's landfills comes from conventional wood construction.
- Due to the extremely air tight construction of an ICF structure, a cleaner environment can be provided more effectively and at lower energy cost by employment of appropriate high efficiency filters. ICF construction provides the tight shell that is a necessary component of providing maximum indoor residential air quality.

ICFs are essentially forms of plastic foam--block systems, panel, or plank--into which concrete is poured. ICFs are used primarily for the construction of walls, but in some cases they have been used to build floors. They are often marketed as environmentally friendly because no CFCs are used in their construction, they replace timber, and they're non-toxic.

These ready-to-cast systems typically consist of expanded-polystyrene (EPS) foam panels or planks, each usually 2 1/2 inches thick, interlocked by either plastic (polyethylene or a polymeric mixture) or metal ties. These ties hold the EPS panels together and provide the space into which concrete is poured. After the concrete has set, the forms are left in place, both insulating the wall and providing surfaces to which the exterior and interior walls can be applied. In all cases--before the concrete is poured--both horizontal and vertical rebar is placed in the cavity of the forms to give integrity to the structure. In effect, this gives a sandwich type of construction, with high strength in the middle and high insulation on the outside. Because of the way they are formed, ICFs are stronger than concrete blocks. In addition, they are lighter than blocks because they use 10%-25% less concrete.

Environmental Issues

Materials use. The primary materials used by ICFs are concrete and the polystyrene forms that surround it. Four ingredients go into the making of concrete: cement (at about 12% of concrete mix); both coarse and fine aggregates--generally gravel and sand (approximately 82%); additives to produce desired properties of the concrete; and water (about 6%). Cement is the crucial ingredient to bind the other components together. All of these materials are considered readily available and nontoxic.

Cement is produced by combining a calcium source, such as limestone, with a silicon source like sand or clay, under high temperatures. The reaction takes place in rotary kilns at up to 2,700°F--thus it requires a great deal of energy. In more and more applications, fly ash--a waste product generated during coal combustion--is used in cement manufacture at up to 15-30% of the total. The fly ash reduces the amount of energy required to manufacture cement.

Stone, rock, and sand are mined and collected and are abundant. The additives, called admixtures, may include such chemicals as inorganic salts, organic compounds, fungicides, or pesticides. The quantities of these are often significantly less than 0.2%, and are considered negligible.

EPS is a petroleum product--a non-renewable resource. However, studies have shown that, as an insulator, EPS can save many times its embedded energy in consumption. In addition, EPS is one of only a few plastics that do not use chlorinated fluorocarbons (CFCs) in manufacturing. The manufacture of EPS generates small volumes of liquid and gaseous wastes, which are treated onsite. Any waste polystyrene generated at the factory is reprocessed.

Energy and resource use. ICFs have greater calculated R-values than typical wood frame construction of the same size. In comparison to standard R-11 walls (2 x 4, 16 inches on center wood frame construction, with R-13 fiberglass insulation, 1/2-inch gypsum interior wallboard, and wood siding) calculated R-values for the 6-inch Amvic ICF block (2 1/2-inch EPS foam panels surrounding 6-inch reinforced poured concrete) is R-22.5. While effective R-values may be more appropriate for comparison, they are difficult to quantify because three factors are involved: thermal resistance of the materials in the wall, thermal mass of the concrete, and air infiltration through the wall assembly.

Construction Technology Laboratories of Skokie, Illinois did a partial life cycle inventory study that compared long-term energy use in common wood frame construction with that in ICF construction in five areas of the United States. They found that cumulative energy use was very substantially greater in the wood frame houses studied than it was in the ICF-built houses. CTL stated that a 5" concrete core ICF performed *effectively* as an R-50 wall when the effects of high thermal mass and low air infiltration were taken into account.

Per ton of material, concrete requires fairly low amounts of energy to excavate, transport, manufacture, and install--much less than EPS. However, since many more tons of concrete go into a home's construction than do other materials, the total embodied energy from concrete in a home is more than from any other material. Still, the energy embodied in these materials is a small fraction of the overall energy consumed in the completed homes by the occupants.

Disposal. Because ICF walls can be built in a modular fashion, trim waste and excess material purchases are minimized. Polystyrene that is waste in the molding of blocks, is recycled into sheet polystyrene products.

For more information or to inquire about building green with Amvic ICF contact: Amvic-Pacific 530/265-9085 or www.amvic-pacific.com