Long Exposure Noise Reduction – reducing thermal image signal noise

Generally:
More heat = more thermal noise
Longer exposures = more thermal noise
Less heat = less thermal noise
Shorter exposures less thermal noise

Cold winter night should always give less noise than hot summer days with the same exposure length.

Long exposure noise reduction reduces the highs and lows per-pixel as some get hot and others are cold, so the dark frame is averaged against the light frame to reduce the noise.

Nikon Shooting Menu Long Exp. NR = ON for landscape shooting or OFF for your own workflow
Canon = off/on/auto
Turn it off for sports/action shooting to keep the buffer high
Use memory banks to keep it all organized and presents ready for your shooting styles

Nikon Raw Format
It is apparent that Nikon adds applies a median blurring filter algorithm to images when Long Exp. NR is on. This is in addition to the low-pass filter in front of the sensor. RAW and JPG files are recorded this way. In order to get a true RAW file without this filter being applied, when Long Exp NR is on, but turn the camera off while the "job nr" is being displayed.

Long exposure noise has very little to do with ISO grain or underexposure grain.

Grain noise reduction
Lower the ISO or use post processing like Noise Ninja or Neat Image.
In Photoshop, you can also change image to LAB color mode. Go to the 'a' channel and reduce noise only on that channel. Then convert back to RGB when done.

Noise reduction by image averaging
Slightly off-topic, but image averaging works on the assumption that the noise in your image is truly random. This way, random fluctuations above and below actual image data will gradually even out as one averages more and more images. See Photoshop CS3 Extended for possible use.

Long Exposure Noise Reduction is less random, and tied more directly to the themal noise over time. But it does increase or decrease in intensity, so one dark frame does not clean up every long exposure.

Astrophotography
Those that shoot astrophotography a lot, often gravitate to certain conditions of temperatures, exposure lengths, time of day, etc. So they acquire a series of dark frames in a library, and apply one that matches the light frame length they recorded.