

By Phil Rawlings

If you have a question about geothermal installation, design or troubleshooting, send it to Phil Rawlings in care of *Geo Outlook*, Oklahoma State University, 499 Cordell South, Stillwater, OK 74078 or via e-mail to kathrej@okstate.edu.



What dictates borehole depth and spacing?

Commercial loop field grid design preparation – do you have:

- a. Calculated, not estimated, heat loss and heat gain
- b. Equipment selected
- c. Loop design temperatures selected
- d. Far field (ground) temperature (from thermal conductivity test(s))
- e. Ground thermal conductivity (from thermal conductivity test(s))
- f. Ground thermal diffusivity (from thermal conductivity test(s))
- g. Thermal conductivity test bore well logs
- h. Pipe diameter options evaluated
- i. Grout options evaluated
- j. Loop field space availability defined
- k. Borehole depth possibilities defined
- l. Environmental and code requirements defined

If you didn't answer yes to all of these, don't start design calculations!

Design – Well fields must be designed to accomplish two tasks: 1) to provide necessary heat source/heat sink capacity required by the system's heat pumps, and 2) to allow the earth to adequately dissipate surplus rejected heat or replenish the effects of absorbed energy over an annual cycle. Grid type well field design must consider the effects of system operation over the expected life of the system. Failure to consider the long term impact of heat rejection or absorption can result in distortion of far field temperatures over time. This distortion can cause cooling dominant loop maximum temperatures to go above design parameters, reducing capacity and efficiency. On heating dominant systems, temperatures can fall below design parameters, with the same results. In extreme cases, loop temperatures can reach levels that will cause system heat pumps to be shut down by their internal safety circuit.

Application – Site conditions can require variation from “normal” design practice. Space availability may require boreholes that are closer together, but deeper. Ground conditions may dictate that holes not be deep enough to accommodate a nominal ton (12,000 BTUH) of capacity, or they can be deeper and accommodate more than a nominal ton of capacity. There are no “rules-of-thumb” for variations in site conditions – don't assume, investigate!

Mr. Rawlings has over twenty-five years experience in the geothermal industry. He is a Certified Geoexchange Designer (CGD) and an IGSHPA Accredited Installer and Trainer.