

# STATISTICAL DESIGN OF EXPERIMENTS IN THE PRESENCE OF RESTRICTIONS AND CONSTRAINTS

Joanne R. Wendelberger

Statistical Sciences Group, CCS-6, MS F600

Los Alamos National Laboratory

Los Alamos, NM 87545

## ABSTRACT

Planning of scientific experiments involves a variety of challenges, both statistical and logistical in nature. Practical considerations such as restrictions on certain factor combinations and resource constraints may limit the applicability of standard statistical designs, requiring some ingenuity in the way designs are constructed from a set of possible candidates. In some cases, careful aliasing of factors in a nonstandard manner can be used to develop fractional designs that allow estimation of the desired effects, while avoiding undesirable factor combinations. Interesting questions arise in the planning of multi-level experiments that involve assessing the tradeoffs between run number, selection of levels, ability to estimate effects, and the degree to which orthogonality can be achieved. The relative merits of fractional factorials, orthogonal arrays, and near-orthogonal arrays for achieving desirable statistical properties are explored, while facing the realities of practical constraints. Strategies for planning degradation experiments with repeated measures are also

discussed. These issues are examined as they arise in the process of designing experiments for materials studies.