Class Projects

Situation

To expand the storage capacity of highly enriched uranium stockpiles, the Nuclear Engineering Department has won a contract to store uranium/water solutions in the Nuclear Engineering Building.

Each of the class projects will concern the writing of a Criticality Safety Evaluation representing one potential combination of a particular storage canister (as much U235 as you can handle—Dr Hines will charge on a per U235 gram basis) and a particular storage location in the building. (Each student will have a different combination of canister and location.)

Feel perfectly free to share information (including measurements and pictures) with other students who have your same canister or building location. But run your own cases (unless you have special permission otherwise) and write your own report.

IMPORTANT: Your final project must be delivered by the deadlines as an email containing a SINGLE WORD document (if you provide more, you will be counted off) that is NO BIGGER than 3 MB in size (if it is bigger, you will be counted off)

Assumptions

Parameters:

1. We can get you as many canisters as you need.
2. UT maintenance will build shelves as you request. They will be ¾" plywood. (Just model the plywood, not supports, etc.)
3. The only limitation you can place on the folks creating your canister is the maximum U-235 concentration allowed in your canister; you CANNOT limit the enrichment or H/U ratio. You can, of course, put any controls you deem necessary on the STORAGE of the canisters while in the building: How many canisters in your location, how high they can be stacked, etc.
4. We want to store as many grams of U-235 as possible.
5. The canisters will be loaded somewhere else, tightly closed, and brought to the building using procedures that you are not responsible for. Each will be labeled with the concentration of U-235 in the canister, known within a 30% error.
6. Assume an appropriate uncertainty on any dimension for measurements you make. You decide the uncertainty based on the measurements you make, but be sure to document how you made this choice in your CSE.
7. The uranium will be assumed to be uniformly mixed with water and fill the canister. (Do not try concentrations above 600 gU235/L, since that is the maximum for uranyl nitrate to stay in solution.)
8. Do not model canister walls—conservatively assume that the U/water mixture goes all the way to the outer dimensions of the canister.

9. All walls in the building (even interior walls) will be assumed to be 6" thick concrete. (The wallboard will be replaced for structural reasons.)
10. Site fire protection tells us that the fire sprinklers are capable of filling the air with 0.01 g/cc water mist in ALL rooms in the building (i.e., assume a sprinkler system even if you don't see one!) AND that water could accumulate as deep as 2 inches on the floor.
11. We are still going to use every room in the building as it currently is used. (i.e., leave room for people to walk down the stairs, walk down halls, etc. (Although you can clear out any stored material that is in the way right now.)
12. I expect to see at least TWO parametric studies:
    A. A comparison of the 4 different concretes (Reg-concrete, MGconcrete, ORconcrete, RFconcrete) with the highest k (for normal case) used in the analysis.
    B. A comparison of the number of canisters on a shelf (again for the normal case), with a concentration limit found for each different number of canisters (from 1 to maximum that will fit). You don't necessarily have to check every number between 1 and Nmax! Just give me a curve. (Looking for the maximum total U-235 mass in the whole array).

Responsibilities

The project assignments are as follows:

Student	Canister	Storage Location
Bethel	A	A
Brackbill	B	A
Freeman	C	A
Jackson	A	B
Lowe	B	B
McKinney	C	B
Mitchell	A	C
Tucker	B	C