SUMMARY OF CONCLUSIONS RELATED TO PA-ASPECTS BASED ON CIGAR LAKE DATA

UO_2 DISSOLUTION AND STABILITY:

- long-term thermodynamic stability under reducing conditions;
- little dissolution achievable during 10^8 a;
- congruent dissolution controlled by surface alteration;

CLAY SEALING:

- clay (in this case illite) can provide effective, long-term sealing;
- long-term stability of illite;
- clay is an efficient barrier to radionuclide and colloid migration;

COLLOIDS:

- colloid and particle contents in groundwater are generally lowest in competent rock and highest in friable rock;
- only a small fraction of radionuclides in water are attached to colloids;
- colloids can be effectively sealed in by clay-rich rocks;
- colloids are not important in radionuclide migration;

ORGANICS AND MICROBES:

- low humic-contents in dilute water are unlikely to play a significant role in either speciation or mobilization of radionuclides;
- microbes can survive in radiation fields, and they can mediate in redox control and buffering;
- organics and microbes are unlikely to adversely affect radionuclide migration in the near field;

SUMMARY OF CONCLUSIONS RELATED TO PA-ASPECTS BASED ON CIGAR LAKE DATA

GROUNDWATER CHEMISTRY:

- interactions with clay minerals control the bulk composition of groundwater;
- redox geochemistry is strongly controlled and buffered by the iron redox-couple;
- evolution of groundwater compositions can be predicted by existing geochemical codes;

RADIOLYSIS:

- radiolytic-oxidation models for UO_2 dissolution appear to be over-conservative in current PA codes;
- dissolved-Fe^{2+} is an important scavenger of radiolytic oxidants;

RADIONUCLIDE MIGRATION:

- natural hydrologic barriers and appropriate geochemical conditions in a relatively-open, natural system are effective in limiting radionuclide migration over any significant distance;
- clay sealing is an important barrier to radionuclide migration.

CONCLUSIONS
CIGAR LAKE

- Little UO_2 dissolution over 1 Ga period under reducing conditions supports predicted long-term stability of UO_2 waste matrix.

- Clay:
  - provides long-term isolation from major aquifer
  - provides a suitable medium for redox control
  - is an effective barrier to radionuclide migration