Beaver Valley FPRA Dependency Analysis

- **Sequences compared to minimal cutsets – example**
  - Consider a non-minimal joint HEP of A-B-C-D
  - A-B is the minimal cutset
  - C and D are non-consequential – their success or failure does not affect change whether the sequence goes to core damage
  - Assume the individual HEP values are
    - A = 0.1
    - B = 0.2
    - C = 0.3
    - D = 0.4
  - The minimal cutset A-B = 0.02

Beaver Valley FPRA Dependency Analysis

- **Sequences compared to minimal cutsets – example**
  - Now consider the sequence results containing this joint HEP
    - All possible sequences containing the minimal cutset A-B will be produced, including all combinations of success and failure of the non-minimal HEPs C and D
  - RISKMAN will produce the following sequences:
    - A=F, B=F, C=F, D=F
    - A=F, B=F, C=F, D=S
    - A=F, B=F, C=S, D=F
    - A=F, B=F, C=S, D=S

Beaver Valley FPRA Dependency Analysis

- **Sequences compared to minimal cutsets – example**
  - Recalling the way sequences are quantified:

A-B-C-D	0.1*0.2*0.3*0.4	0.0024
A-B-C-(1-D)	0.1*0.2*0.3*(1-0.4)	0.0036
A-B-(1-C)-D	0.1*0.2*(1-0.3)*0.4	0.0056
A-B-(1-C)-(1-D)	0.1*0.2*(1-0.3)*(1-0.4)	0.0084

  - Summing the sequences, 0.0024+0.0036+0.0056+0.0084=0.02
  - This is the same value as the minimal cutset result

Beaver Valley FPRA Dependency Analysis

- **Dependency analysis – impact of non-consequential HFEs**
  - If we increase the value of the non-consequential HFEs (C and D) to mimic dependence factor increases, the total value does not change
    - Assume new values are C=0.6, D=0.7 (no change to minimal cutset A-B)
    - New sequences are:

A-B-C-D	0.1*0.2*0.6*0.7	0.0084
A-B-C-(1-D)	0.1*0.2*0.6*(1-0.7)	0.0036
A-B-(1-C)-D	0.1*0.2*(1-0.6)*0.7	0.0056
A-B-(1-C)-(1-D)	0.1*0.2*(1-0.6)*(1-0.7)	0.0024

    - Total value is 0.0084+0.0036+0.0056+0.0024 = 0.02