Appendix. JAGS code for Bayesian analysis of silica data

a. JAGS code incorporating an animal prior with 10-fold uncertainty, untransformed cumulative exposure

```
 model {

  U ~ dlnorm(0, 1/1.175^2)    # 10-fold uncertainty as per NRC
  beta_rat ~ dnorm(0.00296,1/.00063^2)    # rat prior for cumdose
  beta <- beta_rat + log(U)

  # ASSEMBLE CUMULATIVE EXPOSURE FROM JOB HISTORIES
  # repeat cumulative exposure calculation for each of N subjects
  for (i in 1:N) {
    log(e[i]) <- beta*expos[i]    # let e[i] be exp(ZB)
    expos[i] <- sumex[i]
    # calculate true exposure for each job task record (concentration * time)
  }

  # CONDITIONAL LIKELIHOOD FUNCTION
  # Based on Method 2 from the Endo example in the WinBUGS manual
  # I is number of risk sets and J[i] is number of subjects in risk set i
  # CUMJ[i] is running total of J up to J[i-1]
  for (i in 1:I) {
    sumeset[i] <- sum(e[(CUMJ[i]+1):(CUMJ[i]+J[i])])
    for (j in 1:J[i]) {
      p[i, j] <- e[CUMJ[i]+j] / sumeset[i]
    }
    case[(CUMJ[i]+1):(CUMJ[i]+J[i])] ~ dmulti( p[i,1:J[i]] , 1)
  }
}
```

b. JAGS code for analysis adjusting for exposure measurement error, untransformed cumulative exposure, and animal prior with 1-fold uncertainty

```
model {
  k <- 0.79756              # Berkson error multiplier
  logsd <- sqrt(log(k*k+1))     # std dev in log exposure
  tau <- 1/(logsd*logsd)                    # expressed as precision
  beta ~ dnorm(0.00296,1/.00063^2)    # rat prior for cumdose, U=1

  # Measurement error model, applied to each record in the JEM file (d2)
  for (i in 1:K){
    Terr[i] ~ dnorm(1,4)I(0.1,1.9)         # probability model for dust conversion error
    Texp[i] <- jobexp[i] * Terr[i]          # true mean job task exposure
```

```
  }

  # ASSEMBLE CUMULATIVE EXPOSURE FROM JOB HISTORIES
  # repeat cumulative exposure calculation for each of N subjects
  for (i in 1:N) {
    log(e[i]) <- beta*expos[i]            # let e[i] be exp(ZB)
    expos[i] <- cumex[i]
    # calculate true exposure for each job task record (concentration * time)
    for (j in 1:nsteps[i]) {
      expprod[i,j] <- whtime[i,j] * Iexp[i,j]
      # MSMT ERROR FOR EACH PERSON-JOB-EXPOSURE ASSIGNMENT
      logmean[i,j] <- log(Texp[whexprow[i,j]]/sqrt(1+k*k)+1.0E-8)
      Ierr[i,j] ~ dnorm(0,tau)              # probability model for job task msmt error
      Iexp[i,j] <- exp(logmean[i,j] + Ierr[i,j])   # true person job task exposure
    }
    cumex[i] <- sum(expprod[i,1:nsteps[i]])   # sum of exposures across job tasks
    diff[i] <- cumex[i] - sumex[i]
  }
  meandiff <- mean(diff)
  maxabsdiff <-max(abs(diff))

  # CONDITIONAL LIKELIHOOD FUNCTION
  # Based on Method 2 from the Endo example in the WinBUGS manual
  # I is number of risk sets and J[i] is number of subjects in risk set i
  # CUMJ[i] is running total of J up to J[i-1]
  for (i in 1:I) {
    sumeset[i] <- sum(e[(CUMJ[i]+1):(CUMJ[i]+J[i])])
    for (j in 1:J[i]) {
      p[i, j] <- e[CUMJ[i]+j] / sumeset[i]
    }
    case[(CUMJ[i]+1):(CUMJ[i]+J[i])] ~ dmulti( p[i,1:J[i]] , 1)
  }
}
```