

Effective Pest Treatment That Protects Pollinators

[https://github.com/shivanikuckreja/CitrolaKuckrejaSaltman_ENV872_E
DA_FinalProject/tree/main/Project](https://github.com/shivanikuckreja/CitrolaKuckrejaSaltman_ENV872_E
DA_FinalProject/tree/main/Project)

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1 Rationale and Research Questions

Pollination is a critical component of agriculture. Bees are important pollinators. Our research looks to see if there are exposure methods and chemicals that do not cause significant harm to bees while eliminating pests. The goal of our research is to determine potential treatment methods that reduce pests while having little to no impact on bees.

Questions:

1. *Is there an exposure type that has less impact on bees than non-bee insects?*
2. *Are there chemicals that have a high mortality rate for non-bee insects and low rate for bees?*

2 Dataset Information

Data Source: The dataset was pulled from a repository created for Environmental Data Analytics at Duke University in 2020. The data collected is from several EPA studies on neonicotinoids and their effects on insects. The data we will be analyzing is the type of chemical administered, how it was administered, and how both of these variables affected insects.

In the wrangling process, we selected the relevant information to our topic. This includes the chemical type, insect species, lifestage and age of the species, exposure type and the effect of the exposure.

```
#Which exposure types have a significant effect (mortality) on bee species?  
#Do not group. Want to see nuances between similar categories
```

```
BeeMortalityExposureType$Mortality <- ifelse(BeeMortalityExposureType$Effect=="Mortality",  
#Making new column categorical  
BeeMortalityExposureType$Mortality <- as.factor(BeeMortalityExposureType$Mortality)  
  
logit <- glm(Mortality ~ Exposure.Type, data = BeeMortalityExposureType, family = "binomial")  
summary(logit)
```

```
##  
## Call:  
## glm(formula = Mortality ~ Exposure.Type, family = "binomial",  
##      data = BeeMortalityExposureType)  
##  
## Deviance Residuals:  
##      Min       1Q   Median       3Q      Max   
## -1.4620  -0.7742  -0.7742   1.1774   1.9728   
##  
## Coefficients:  
##                                     Estimate Std. Error  
## (Intercept)                       -0.5306      0.3985  
## Exposure.TypeDermal                 -0.8747      0.5046  
## Exposure.TypeDiet, unspecified       0.5306      0.5836  
## Exposure.TypeDirect application    -16.0354    1696.7344  
## Exposure.TypeDrinking water        17.0967    2399.5448  
## Exposure.TypeDropwise               17.0967    2399.5448  
## Exposure.TypeEnvironmental, unspecified  0.1252      0.4343  
## Exposure.TypeFood                  -0.5208      0.4052  
## Exposure.TypeGround granular       -16.0354    1073.1091  
## Exposure.TypeHand spray            -16.0354    1199.7724  
## Exposure.TypeMultiple routes between application groups -1.2611      1.1513  
## Exposure.TypeOral via capsule       17.0967     550.4935
```

```
## Exposure.TypeSpray                0.2587      0.5186
## Exposure.TypeTopical, general      1.1787      0.4512
##                                z value Pr(>|z|)
## (Intercept)                       -1.331     0.183
## Exposure.TypeDermal                -1.734     0.083 .
## Exposure.TypeDiet, unspecified      0.909     0.363
## Exposure.TypeDirect application    -0.009     0.992
## Exposure.TypeDrinking water         0.007     0.994
## Exposure.TypeDropwise               0.007     0.994
## Exposure.TypeEnvironmental, unspecified 0.288     0.773
## Exposure.TypeFood                  -1.285     0.199
## Exposure.TypeGround granular        -0.015     0.988
## Exposure.TypeHand spray             -0.013     0.989
## Exposure.TypeMultiple routes between application groups -1.095     0.273
## Exposure.TypeOral via capsule        0.031     0.975
## Exposure.TypeSpray                  0.499     0.618
## Exposure.TypeTopical, general        2.612     0.009 **
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
```

```
## (Dispersion parameter for binomial family taken to be 1)
```

```
##
```

```
## Null deviance: 1757.6 on 1406 degrees of freedom
```

```
## Residual deviance: 1621.4 on 1393 degrees of freedom
```

```
## AIC: 1649.4
```

```
##
```

```
## Number of Fisher Scoring iterations: 15
```

#For every one unit change in Topical, the odds of mortality increase by 1.1787. The P

#Significance: Total topical samples 99 - mortality - 65

#Additional data collection is needed on: Exposure through soil contact, drinking

#Which exposure types have a significant effect (mortality) on non bee species?

```
NonBeeMortalityExposure$Mortality <- ifelse(NonBeeMortalityExposure$Effect=="Mortality",
```

#Making new column categorical

```
NonBeeMortalityExposure$Mortality <- as.factor(NonBeeMortalityExposure$Mortality)
```

```
logit2 <- glm(Mortality ~ Exposure.Type, data = NonBeeMortalityExposure, family = "binom
summary(logit2)
```

```
##
```

```
## Call:
```

```
## glm(formula = Mortality ~ Exposure.Type, family = "binomial",
```

```
##      data = NonBeeMortalityExposure)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q        Max
## -2.2581   -1.0150   -0.1775    1.2435    2.9497
##
## Coefficients:
##                                     Estimate
## (Intercept)                        1.1896
## Exposure.TypeDiet, unspecified      -0.4964
## Exposure.TypeDipped or soaked      -1.3921
## Exposure.TypeDirect application    -1.9780
## Exposure.TypeDrinking water        -1.3437
## Exposure.TypeEnvironmental, unspecified -1.5843
## Exposure.TypeFilmcoating           -18.7557
## Exposure.TypeFoliar spray          -5.5269
## Exposure.TypeFood                  -0.4814
## Exposure.TypeGround granular       -18.7557
## Exposure.TypeGround spray          -5.3327
## Exposure.TypeHand spray            -2.8824
## Exposure.TypeImmersion              16.3765
## Exposure.TypeMisted                -18.7557
## Exposure.TypeMultiple routes within environmental exposures -18.7557
## Exposure.TypePresent in soil       -18.7557
## Exposure.TypeSpray                 -2.5710
## Exposure.TypeTopical, general       1.2785
## Exposure.TypeWatered               -18.7557
##                                     Std. Error z value
## (Intercept)                        0.4317  2.756
## Exposure.TypeDiet, unspecified      0.9676 -0.513
## Exposure.TypeDipped or soaked      0.4727 -2.945
## Exposure.TypeDirect application    0.4774 -4.144
## Exposure.TypeDrinking water        0.5840 -2.301
## Exposure.TypeEnvironmental, unspecified 0.4358 -3.635
## Exposure.TypeFilmcoating          3956.1804 -0.005
## Exposure.TypeFoliar spray          0.8324 -6.640
## Exposure.TypeFood                  0.4812 -1.000
## Exposure.TypeGround granular       273.0027 -0.069
## Exposure.TypeGround spray          1.0965 -4.864
## Exposure.TypeHand spray            0.4877 -5.911
## Exposure.TypeImmersion             3956.1804  0.004
## Exposure.TypeMisted                1398.7210 -0.013
## Exposure.TypeMultiple routes within environmental exposures 2797.4420 -0.007
## Exposure.TypePresent in soil       2284.1018 -0.008
## Exposure.TypeSpray                 0.4592 -5.599
```



```

## Exposure.TypeTopical, general          0.5430    2.355
## Exposure.TypeWatered                  1142.0510   -0.016
##                                         Pr(>|z|)
## (Intercept)                          0.005855 **
## Exposure.TypeDiet, unspecified         0.607926
## Exposure.TypeDipped or soaked         0.003227 **
## Exposure.TypeDirect application        3.42e-05 ***
## Exposure.TypeDrinking water           0.021404 *
## Exposure.TypeEnvironmental, unspecified 0.000278 ***
## Exposure.TypeFilmcoating              0.996217
## Exposure.TypeFoliar spray             3.14e-11 ***
## Exposure.TypeFood                     0.317121
## Exposure.TypeGround granular           0.945227
## Exposure.TypeGround spray              1.15e-06 ***
## Exposure.TypeHand spray                3.41e-09 ***
## Exposure.TypeImmersion                 0.996697
## Exposure.TypeMisted                    0.989301
## Exposure.TypeMultiple routes within environmental exposures 0.994651
## Exposure.TypePresent in soil           0.993448
## Exposure.TypeSpray                     2.16e-08 ***
## Exposure.TypeTopical, general          0.018538 *
## Exposure.TypeWatered                   0.986897
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 3233.2  on 2528  degrees of freedom
## Residual deviance: 2540.4  on 2510  degrees of freedom
## AIC: 2578.4
##
## Number of Fisher Scoring iterations: 16
#Dipped or soaked, Direct application, Environmental- unspecified, Foliar spray, Ground
#Plenty of samples for non-bees - correlations
#Conclusion: Spray could be an effective anthropogenic exposure technique to eliminate
#Which chemical types have a significant effect (mortality) on bee species?
logit3 <- glm(Mortality ~ CAS.Number, data = BeeMortalityExposureType, family = "binomial")
summary(logit3)

##
## Call:

```

```
## glm(formula = Mortality ~ CAS.Number, family = "binomial", data = BeeMortalityExposur
##
## Deviance Residuals:
##      Min        1Q      Median        3Q        Max
## -1.5453   -0.7585   -0.7585    1.2286    1.7080
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)      0.8329     0.3788   2.199 0.027885 *
## CAS.Number135410207 -2.0268     0.4568  -4.437 9.10e-06 ***
## CAS.Number138261413 -1.9315     0.3879  -4.979 6.39e-07 ***
## CAS.Number150824478 11.7332    324.7439   0.036 0.971178
## CAS.Number153719234 -0.9526     0.3993  -2.385 0.017062 *
## CAS.Number165252700 -1.4276     0.4904  -2.911 0.003599 **
## CAS.Number210880925 -1.5066     0.4035  -3.734 0.000189 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 1757.6  on 1406  degrees of freedom
## Residual deviance: 1689.6  on 1400  degrees of freedom
## AIC: 1703.6
##
## Number of Fisher Scoring iterations: 11
```

#Need more data on 58842209 105843365 and 58842209, 150824478
Every other chemical is statistically significant - 111988499 135410207 138261413

#Which exposure types have a significant effect (mortality) on non bee species?

```
logit4 <- glm(Mortality ~ CAS.Number, data = NonBeeMortalityExposure, family = "binomial"
summary(logit4)
```

```
##
## Call:
## glm(formula = Mortality ~ CAS.Number, family = "binomial", data = NonBeeMortalityExpo
##
## Deviance Residuals:
##      Min        1Q      Median        3Q        Max
## -1.5928   -0.8379   -0.8379    1.2907    1.9027
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)      1.557e+01  4.602e+02   0.034   0.973
## CAS.Number105843365  1.448e-09  6.509e+02   0.000   1.000
```

```
## CAS.Number111988499 -1.507e+01 4.602e+02 -0.033 0.974
## CAS.Number135410207 -1.583e+01 4.602e+02 -0.034 0.973
## CAS.Number138261413 -1.643e+01 4.602e+02 -0.036 0.972
## CAS.Number150824478 -1.463e+01 4.602e+02 -0.032 0.975
## CAS.Number153719234 -1.615e+01 4.602e+02 -0.035 0.972
## CAS.Number165252700 -1.580e+01 4.602e+02 -0.034 0.973
## CAS.Number210880925 -1.720e+01 4.602e+02 -0.037 0.970
```

```
##
```

```
## (Dispersion parameter for binomial family taken to be 1)
```

```
##
```

```
## Null deviance: 3233.2 on 2528 degrees of freedom
```

```
## Residual deviance: 3091.8 on 2520 degrees of freedom
```

```
## AIC: 3109.8
```

```
##
```

```
## Number of Fisher Scoring iterations: 14
```

There is no chemical that is effective at eliminating all non-bee species.

Conclusion - exposure mechanism of chemical is a more reliable factor at understanding

```
logit5 <- glm(Mortality ~ CAS.Number * Exposure.Type, data = NonBeeMortalityExposure, family = "binomial")
```

```
## Warning: glm.fit: algorithm did not converge
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```
summary(logit5)
```

```
##
```

```
## Call:
```

```
## glm(formula = Mortality ~ CAS.Number * Exposure.Type, family = "binomial",
```

```
## data = NonBeeMortalityExposure)
```

```
##
```

```
## Deviance Residuals:
```

```
## Min 1Q Median 3Q Max
```

```
## -2.4230 -0.9870 -0.1678 0.9091 2.9223
```

```
##
```

```
## Coefficients: (92 not defined because of singularities)
```

```
##
```

```
## (Intercept)
```

```
## CAS.Number105843365
```

```
## CAS.Number111988499
```

```
## CAS.Number135410207
```

```
## CAS.Number138261413
```

```
## CAS.Number150824478
```

```
## CAS.Number153719234
```

```
## CAS.Number165252700
```

```
## CAS.Number210880925
```

```
Est
```

```
1.79
```

```
4.50
```

```
-7.21
```

```
1.80
```

```
-1.79
```

```
-3.41
```

```
-1.79
```

```
-1.79
```

```
-1.25
```

## Exposure.TypeDiet, unspecified	6.46
## Exposure.TypeDipped or soaked	-2.75
## Exposure.TypeDirect application	-1.79
## Exposure.TypeDrinking water	-7.72
## Exposure.TypeEnvironmental, unspecified	-1.79
## Exposure.TypeFilmcoating	-2.71
## Exposure.TypeFoliar spray	-5.26
## Exposure.TypeFood	-1.79
## Exposure.TypeGround granular	-4.87
## Exposure.TypeGround spray	-2.86
## Exposure.TypeHand spray	-1.79
## Exposure.TypeImmersion	4.34
## Exposure.TypeMisted	-5.39
## Exposure.TypeMultiple routes within environmental exposures	-3.41
## Exposure.TypePresent in soil	-2.86
## Exposure.TypeSpray	-1.00
## Exposure.TypeTopical, general	1.75
## Exposure.TypeWatered	-4.50
## CAS.Number105843365:Exposure.TypeDiet, unspecified	
## CAS.Number111988499:Exposure.TypeDiet, unspecified	
## CAS.Number135410207:Exposure.TypeDiet, unspecified	4.49
## CAS.Number138261413:Exposure.TypeDiet, unspecified	-6.46
## CAS.Number150824478:Exposure.TypeDiet, unspecified	4.53
## CAS.Number153719234:Exposure.TypeDiet, unspecified	
## CAS.Number165252700:Exposure.TypeDiet, unspecified	
## CAS.Number210880925:Exposure.TypeDiet, unspecified	4.49
## CAS.Number105843365:Exposure.TypeDipped or soaked	
## CAS.Number111988499:Exposure.TypeDipped or soaked	-4.49
## CAS.Number135410207:Exposure.TypeDipped or soaked	-3.59
## CAS.Number138261413:Exposure.TypeDipped or soaked	2.70
## CAS.Number150824478:Exposure.TypeDipped or soaked	3.39
## CAS.Number153719234:Exposure.TypeDipped or soaked	-1.00
## CAS.Number165252700:Exposure.TypeDipped or soaked	
## CAS.Number210880925:Exposure.TypeDipped or soaked	
## CAS.Number105843365:Exposure.TypeDirect application	
## CAS.Number111988499:Exposure.TypeDirect application	
## CAS.Number135410207:Exposure.TypeDirect application	-1.80
## CAS.Number138261413:Exposure.TypeDirect application	1.79
## CAS.Number150824478:Exposure.TypeDirect application	
## CAS.Number153719234:Exposure.TypeDirect application	1.79
## CAS.Number165252700:Exposure.TypeDirect application	1.79
## CAS.Number210880925:Exposure.TypeDirect application	
## CAS.Number105843365:Exposure.TypeDrinking water	
## CAS.Number111988499:Exposure.TypeDrinking water	
## CAS.Number135410207:Exposure.TypeDrinking water	

## CAS.Number138261413:Exposure.TypeDrinking water	7.72
## CAS.Number150824478:Exposure.TypeDrinking water	
## CAS.Number153719234:Exposure.TypeDrinking water	-4.50
## CAS.Number165252700:Exposure.TypeDrinking water	
## CAS.Number210880925:Exposure.TypeDrinking water	
## CAS.Number105843365:Exposure.TypeEnvironmental, unspecified	
## CAS.Number111988499:Exposure.TypeEnvironmental, unspecified	7.21
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	-1.80
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	1.79
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	3.41
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	1.79
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	1.79
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	
## CAS.Number105843365:Exposure.TypeFilmcoating	
## CAS.Number111988499:Exposure.TypeFilmcoating	
## CAS.Number135410207:Exposure.TypeFilmcoating	
## CAS.Number138261413:Exposure.TypeFilmcoating	
## CAS.Number150824478:Exposure.TypeFilmcoating	
## CAS.Number153719234:Exposure.TypeFilmcoating	
## CAS.Number165252700:Exposure.TypeFilmcoating	
## CAS.Number210880925:Exposure.TypeFilmcoating	
## CAS.Number105843365:Exposure.TypeFoliar spray	
## CAS.Number111988499:Exposure.TypeFoliar spray	
## CAS.Number135410207:Exposure.TypeFoliar spray	4.90
## CAS.Number138261413:Exposure.TypeFoliar spray	5.26
## CAS.Number150824478:Exposure.TypeFoliar spray	
## CAS.Number153719234:Exposure.TypeFoliar spray	5.26
## CAS.Number165252700:Exposure.TypeFoliar spray	5.26
## CAS.Number210880925:Exposure.TypeFoliar spray	5.08
## CAS.Number105843365:Exposure.TypeFood	
## CAS.Number111988499:Exposure.TypeFood	
## CAS.Number135410207:Exposure.TypeFood	
## CAS.Number138261413:Exposure.TypeFood	1.79
## CAS.Number150824478:Exposure.TypeFood	3.41
## CAS.Number153719234:Exposure.TypeFood	1.79
## CAS.Number165252700:Exposure.TypeFood	1.79
## CAS.Number210880925:Exposure.TypeFood	
## CAS.Number105843365:Exposure.TypeGround granular	
## CAS.Number111988499:Exposure.TypeGround granular	
## CAS.Number135410207:Exposure.TypeGround granular	
## CAS.Number138261413:Exposure.TypeGround granular	2.00
## CAS.Number150824478:Exposure.TypeGround granular	
## CAS.Number153719234:Exposure.TypeGround granular	
## CAS.Number165252700:Exposure.TypeGround granular	
## CAS.Number210880925:Exposure.TypeGround granular	

## CAS.Number105843365:Exposure.TypeGround	spray	
## CAS.Number111988499:Exposure.TypeGround	spray	
## CAS.Number135410207:Exposure.TypeGround	spray	-3.59
## CAS.Number138261413:Exposure.TypeGround	spray	-4.50
## CAS.Number150824478:Exposure.TypeGround	spray	
## CAS.Number153719234:Exposure.TypeGround	spray	-1.78
## CAS.Number165252700:Exposure.TypeGround	spray	
## CAS.Number210880925:Exposure.TypeGround	spray	
## CAS.Number105843365:Exposure.TypeHand	spray	
## CAS.Number111988499:Exposure.TypeHand	spray	7.21
## CAS.Number135410207:Exposure.TypeHand	spray	-1.80
## CAS.Number138261413:Exposure.TypeHand	spray	1.79
## CAS.Number150824478:Exposure.TypeHand	spray	
## CAS.Number153719234:Exposure.TypeHand	spray	1.79
## CAS.Number165252700:Exposure.TypeHand	spray	1.79
## CAS.Number210880925:Exposure.TypeHand	spray	
## CAS.Number105843365:Exposure.TypeImmersion		
## CAS.Number111988499:Exposure.TypeImmersion		
## CAS.Number135410207:Exposure.TypeImmersion		
## CAS.Number138261413:Exposure.TypeImmersion		
## CAS.Number150824478:Exposure.TypeImmersion		
## CAS.Number153719234:Exposure.TypeImmersion		
## CAS.Number165252700:Exposure.TypeImmersion		
## CAS.Number210880925:Exposure.TypeImmersion		
## CAS.Number105843365:Exposure.TypeMisted		
## CAS.Number111988499:Exposure.TypeMisted		
## CAS.Number135410207:Exposure.TypeMisted		-3.59
## CAS.Number138261413:Exposure.TypeMisted		
## CAS.Number150824478:Exposure.TypeMisted		
## CAS.Number153719234:Exposure.TypeMisted		
## CAS.Number165252700:Exposure.TypeMisted		
## CAS.Number210880925:Exposure.TypeMisted		
## CAS.Number105843365:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number111988499:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number135410207:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number138261413:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number150824478:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number153719234:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number165252700:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number210880925:Exposure.TypeMultiple	routes within environmental exposures	
## CAS.Number105843365:Exposure.TypePresent	in soil	
## CAS.Number111988499:Exposure.TypePresent	in soil	
## CAS.Number135410207:Exposure.TypePresent	in soil	
## CAS.Number138261413:Exposure.TypePresent	in soil	
## CAS.Number150824478:Exposure.TypePresent	in soil	

## CAS.Number153719234:Exposure.TypePresent in soil	
## CAS.Number165252700:Exposure.TypePresent in soil	
## CAS.Number210880925:Exposure.TypePresent in soil	
## CAS.Number105843365:Exposure.TypeSpray	
## CAS.Number111988499:Exposure.TypeSpray	8.03
## CAS.Number135410207:Exposure.TypeSpray	6.42
## CAS.Number138261413:Exposure.TypeSpray	1.00
## CAS.Number150824478:Exposure.TypeSpray	
## CAS.Number153719234:Exposure.TypeSpray	1.00
## CAS.Number165252700:Exposure.TypeSpray	1.00
## CAS.Number210880925:Exposure.TypeSpray	8.23
## CAS.Number105843365:Exposure.TypeTopical, general	
## CAS.Number111988499:Exposure.TypeTopical, general	4.49
## CAS.Number135410207:Exposure.TypeTopical, general	-1.79
## CAS.Number138261413:Exposure.TypeTopical, general	-1.75
## CAS.Number150824478:Exposure.TypeTopical, general	
## CAS.Number153719234:Exposure.TypeTopical, general	-1.75
## CAS.Number165252700:Exposure.TypeTopical, general	-1.75
## CAS.Number210880925:Exposure.TypeTopical, general	
## CAS.Number105843365:Exposure.TypeWatered	
## CAS.Number111988499:Exposure.TypeWatered	
## CAS.Number135410207:Exposure.TypeWatered	
## CAS.Number138261413:Exposure.TypeWatered	-4.06
## CAS.Number150824478:Exposure.TypeWatered	
## CAS.Number153719234:Exposure.TypeWatered	
## CAS.Number165252700:Exposure.TypeWatered	
## CAS.Number210880925:Exposure.TypeWatered	
##	Std.
## (Intercept)	1.60
## CAS.Number105843365	2.12
## CAS.Number111988499	1.12
## CAS.Number135410207	2.44
## CAS.Number138261413	1.60
## CAS.Number150824478	8.83
## CAS.Number153719234	1.60
## CAS.Number165252700	1.60
## CAS.Number210880925	1.54
## Exposure.TypeDiet, unspecified	1.33
## Exposure.TypeDipped or soaked	1.49
## Exposure.TypeDirect application	1.60
## Exposure.TypeDrinking water	1.92
## Exposure.TypeEnvironmental, unspecified	1.60
## Exposure.TypeFilmcoating	4.16
## Exposure.TypeFoliar spray	1.93
## Exposure.TypeFood	1.60

## Exposure.TypeGround granular	6.43
## Exposure.TypeGround spray	1.49
## Exposure.TypeHand spray	1.60
## Exposure.TypeImmersion	6.71
## Exposure.TypeMisted	7.79
## Exposure.TypeMultiple routes within environmental exposures	4.74
## Exposure.TypePresent in soil	3.21
## Exposure.TypeSpray	6.49
## Exposure.TypeTopical, general	2.16
## Exposure.TypeWatered	4.74
## CAS.Number105843365:Exposure.TypeDiet, unspecified	
## CAS.Number111988499:Exposure.TypeDiet, unspecified	
## CAS.Number135410207:Exposure.TypeDiet, unspecified	1.33
## CAS.Number138261413:Exposure.TypeDiet, unspecified	1.33
## CAS.Number150824478:Exposure.TypeDiet, unspecified	1.63
## CAS.Number153719234:Exposure.TypeDiet, unspecified	
## CAS.Number165252700:Exposure.TypeDiet, unspecified	
## CAS.Number210880925:Exposure.TypeDiet, unspecified	1.33
## CAS.Number105843365:Exposure.TypeDipped or soaked	
## CAS.Number111988499:Exposure.TypeDipped or soaked	1.11
## CAS.Number135410207:Exposure.TypeDipped or soaked	2.71
## CAS.Number138261413:Exposure.TypeDipped or soaked	1.49
## CAS.Number150824478:Exposure.TypeDipped or soaked	8.86
## CAS.Number153719234:Exposure.TypeDipped or soaked	6.60
## CAS.Number165252700:Exposure.TypeDipped or soaked	
## CAS.Number210880925:Exposure.TypeDipped or soaked	
## CAS.Number105843365:Exposure.TypeDirect application	
## CAS.Number111988499:Exposure.TypeDirect application	
## CAS.Number135410207:Exposure.TypeDirect application	2.44
## CAS.Number138261413:Exposure.TypeDirect application	1.60
## CAS.Number150824478:Exposure.TypeDirect application	
## CAS.Number153719234:Exposure.TypeDirect application	1.60
## CAS.Number165252700:Exposure.TypeDirect application	1.60
## CAS.Number210880925:Exposure.TypeDirect application	
## CAS.Number105843365:Exposure.TypeDrinking water	
## CAS.Number111988499:Exposure.TypeDrinking water	
## CAS.Number135410207:Exposure.TypeDrinking water	
## CAS.Number138261413:Exposure.TypeDrinking water	1.92
## CAS.Number150824478:Exposure.TypeDrinking water	
## CAS.Number153719234:Exposure.TypeDrinking water	1.92
## CAS.Number165252700:Exposure.TypeDrinking water	
## CAS.Number210880925:Exposure.TypeDrinking water	
## CAS.Number105843365:Exposure.TypeEnvironmental, unspecified	
## CAS.Number111988499:Exposure.TypeEnvironmental, unspecified	1.12
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	2.44

## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	1.60
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	8.83
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	1.60
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	1.60
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	
## CAS.Number105843365:Exposure.TypeFilmcoating	
## CAS.Number111988499:Exposure.TypeFilmcoating	
## CAS.Number135410207:Exposure.TypeFilmcoating	
## CAS.Number138261413:Exposure.TypeFilmcoating	
## CAS.Number150824478:Exposure.TypeFilmcoating	
## CAS.Number153719234:Exposure.TypeFilmcoating	
## CAS.Number165252700:Exposure.TypeFilmcoating	
## CAS.Number210880925:Exposure.TypeFilmcoating	
## CAS.Number105843365:Exposure.TypeFoliar spray	
## CAS.Number111988499:Exposure.TypeFoliar spray	
## CAS.Number135410207:Exposure.TypeFoliar spray	1.94
## CAS.Number138261413:Exposure.TypeFoliar spray	1.93
## CAS.Number150824478:Exposure.TypeFoliar spray	
## CAS.Number153719234:Exposure.TypeFoliar spray	1.93
## CAS.Number165252700:Exposure.TypeFoliar spray	1.93
## CAS.Number210880925:Exposure.TypeFoliar spray	1.93
## CAS.Number105843365:Exposure.TypeFood	
## CAS.Number111988499:Exposure.TypeFood	
## CAS.Number135410207:Exposure.TypeFood	
## CAS.Number138261413:Exposure.TypeFood	1.60
## CAS.Number150824478:Exposure.TypeFood	8.83
## CAS.Number153719234:Exposure.TypeFood	1.60
## CAS.Number165252700:Exposure.TypeFood	1.60
## CAS.Number210880925:Exposure.TypeFood	
## CAS.Number105843365:Exposure.TypeGround granular	
## CAS.Number111988499:Exposure.TypeGround granular	
## CAS.Number135410207:Exposure.TypeGround granular	
## CAS.Number138261413:Exposure.TypeGround granular	6.44
## CAS.Number150824478:Exposure.TypeGround granular	
## CAS.Number153719234:Exposure.TypeGround granular	
## CAS.Number165252700:Exposure.TypeGround granular	
## CAS.Number210880925:Exposure.TypeGround granular	
## CAS.Number105843365:Exposure.TypeGround spray	
## CAS.Number111988499:Exposure.TypeGround spray	
## CAS.Number135410207:Exposure.TypeGround spray	2.71
## CAS.Number138261413:Exposure.TypeGround spray	8.96
## CAS.Number150824478:Exposure.TypeGround spray	
## CAS.Number153719234:Exposure.TypeGround spray	6.60
## CAS.Number165252700:Exposure.TypeGround spray	
## CAS.Number210880925:Exposure.TypeGround spray	

## CAS.Number105843365:Exposure.TypeHand spray	
## CAS.Number111988499:Exposure.TypeHand spray	1.12
## CAS.Number135410207:Exposure.TypeHand spray	2.44
## CAS.Number138261413:Exposure.TypeHand spray	1.60
## CAS.Number150824478:Exposure.TypeHand spray	
## CAS.Number153719234:Exposure.TypeHand spray	1.60
## CAS.Number165252700:Exposure.TypeHand spray	1.60
## CAS.Number210880925:Exposure.TypeHand spray	
## CAS.Number105843365:Exposure.TypeImmersion	
## CAS.Number111988499:Exposure.TypeImmersion	
## CAS.Number135410207:Exposure.TypeImmersion	
## CAS.Number138261413:Exposure.TypeImmersion	
## CAS.Number150824478:Exposure.TypeImmersion	
## CAS.Number153719234:Exposure.TypeImmersion	
## CAS.Number165252700:Exposure.TypeImmersion	
## CAS.Number210880925:Exposure.TypeImmersion	
## CAS.Number105843365:Exposure.TypeMisted	
## CAS.Number111988499:Exposure.TypeMisted	
## CAS.Number135410207:Exposure.TypeMisted	2.71
## CAS.Number138261413:Exposure.TypeMisted	
## CAS.Number150824478:Exposure.TypeMisted	
## CAS.Number153719234:Exposure.TypeMisted	
## CAS.Number165252700:Exposure.TypeMisted	
## CAS.Number210880925:Exposure.TypeMisted	
## CAS.Number105843365:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number111988499:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number135410207:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number138261413:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number150824478:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number153719234:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number165252700:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number210880925:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number105843365:Exposure.TypePresent in soil	
## CAS.Number111988499:Exposure.TypePresent in soil	
## CAS.Number135410207:Exposure.TypePresent in soil	
## CAS.Number138261413:Exposure.TypePresent in soil	
## CAS.Number150824478:Exposure.TypePresent in soil	
## CAS.Number153719234:Exposure.TypePresent in soil	
## CAS.Number165252700:Exposure.TypePresent in soil	
## CAS.Number210880925:Exposure.TypePresent in soil	
## CAS.Number105843365:Exposure.TypeSpray	
## CAS.Number111988499:Exposure.TypeSpray	9.65
## CAS.Number135410207:Exposure.TypeSpray	5.96
## CAS.Number138261413:Exposure.TypeSpray	6.49
## CAS.Number150824478:Exposure.TypeSpray	

## CAS.Number153719234:Exposure.TypeSpray	6.49
## CAS.Number165252700:Exposure.TypeSpray	6.49
## CAS.Number210880925:Exposure.TypeSpray	6.67
## CAS.Number105843365:Exposure.TypeTopical, general	
## CAS.Number111988499:Exposure.TypeTopical, general	2.28
## CAS.Number135410207:Exposure.TypeTopical, general	2.19
## CAS.Number138261413:Exposure.TypeTopical, general	2.16
## CAS.Number150824478:Exposure.TypeTopical, general	
## CAS.Number153719234:Exposure.TypeTopical, general	2.16
## CAS.Number165252700:Exposure.TypeTopical, general	2.16
## CAS.Number210880925:Exposure.TypeTopical, general	
## CAS.Number105843365:Exposure.TypeWatered	
## CAS.Number111988499:Exposure.TypeWatered	
## CAS.Number135410207:Exposure.TypeWatered	
## CAS.Number138261413:Exposure.TypeWatered	5.19
## CAS.Number150824478:Exposure.TypeWatered	
## CAS.Number153719234:Exposure.TypeWatered	
## CAS.Number165252700:Exposure.TypeWatered	
## CAS.Number210880925:Exposure.TypeWatered	
##	z
## (Intercept)	1.12
## CAS.Number105843365	2.12
## CAS.Number111988499	-6.43
## CAS.Number135410207	7.40
## CAS.Number138261413	-1.12
## CAS.Number150824478	-3.87
## CAS.Number153719234	-1.12
## CAS.Number165252700	-1.12
## CAS.Number210880925	-8.11
## Exposure.TypeDiet, unspecified	4.80
## Exposure.TypeDipped or soaked	0.00
## Exposure.TypeDirect application	-1.12
## Exposure.TypeDrinking water	-4.00
## Exposure.TypeEnvironmental, unspecified	-1.12
## Exposure.TypeFilmcoating	0.00
## Exposure.TypeFoliar spray	-2.70
## Exposure.TypeFood	-1.12
## Exposure.TypeGround granular	0.00
## Exposure.TypeGround spray	0.00
## Exposure.TypeHand spray	-1.12
## Exposure.TypeImmersion	0.00
## Exposure.TypeMisted	0.00
## Exposure.TypeMultiple routes within environmental exposures	0.00
## Exposure.TypePresent in soil	0.00
## Exposure.TypeSpray	-1.54

## Exposure.TypeTopical, general	8.13
## Exposure.TypeWatered	-9.48
## CAS.Number105843365:Exposure.TypeDiet, unspecified	
## CAS.Number111988499:Exposure.TypeDiet, unspecified	
## CAS.Number135410207:Exposure.TypeDiet, unspecified	3.36
## CAS.Number138261413:Exposure.TypeDiet, unspecified	-4.80
## CAS.Number150824478:Exposure.TypeDiet, unspecified	2.77
## CAS.Number153719234:Exposure.TypeDiet, unspecified	
## CAS.Number165252700:Exposure.TypeDiet, unspecified	
## CAS.Number210880925:Exposure.TypeDiet, unspecified	3.35
## CAS.Number105843365:Exposure.TypeDipped or soaked	
## CAS.Number111988499:Exposure.TypeDipped or soaked	-4.05
## CAS.Number135410207:Exposure.TypeDipped or soaked	-1.32
## CAS.Number138261413:Exposure.TypeDipped or soaked	0.00
## CAS.Number150824478:Exposure.TypeDipped or soaked	3.84
## CAS.Number153719234:Exposure.TypeDipped or soaked	0.00
## CAS.Number165252700:Exposure.TypeDipped or soaked	
## CAS.Number210880925:Exposure.TypeDipped or soaked	
## CAS.Number105843365:Exposure.TypeDirect application	
## CAS.Number111988499:Exposure.TypeDirect application	
## CAS.Number135410207:Exposure.TypeDirect application	-7.40
## CAS.Number138261413:Exposure.TypeDirect application	1.12
## CAS.Number150824478:Exposure.TypeDirect application	
## CAS.Number153719234:Exposure.TypeDirect application	1.12
## CAS.Number165252700:Exposure.TypeDirect application	1.12
## CAS.Number210880925:Exposure.TypeDirect application	
## CAS.Number105843365:Exposure.TypeDrinking water	
## CAS.Number111988499:Exposure.TypeDrinking water	
## CAS.Number135410207:Exposure.TypeDrinking water	
## CAS.Number138261413:Exposure.TypeDrinking water	4.00
## CAS.Number150824478:Exposure.TypeDrinking water	
## CAS.Number153719234:Exposure.TypeDrinking water	-2.33
## CAS.Number165252700:Exposure.TypeDrinking water	
## CAS.Number210880925:Exposure.TypeDrinking water	
## CAS.Number105843365:Exposure.TypeEnvironmental, unspecified	
## CAS.Number111988499:Exposure.TypeEnvironmental, unspecified	6.43
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	-7.40
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	1.12
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	3.87
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	1.12
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	1.12
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	
## CAS.Number105843365:Exposure.TypeFilmcoating	
## CAS.Number111988499:Exposure.TypeFilmcoating	
## CAS.Number135410207:Exposure.TypeFilmcoating	

## CAS.Number138261413:Exposure.TypeFilmcoating	
## CAS.Number150824478:Exposure.TypeFilmcoating	
## CAS.Number153719234:Exposure.TypeFilmcoating	
## CAS.Number165252700:Exposure.TypeFilmcoating	
## CAS.Number210880925:Exposure.TypeFilmcoating	
## CAS.Number105843365:Exposure.TypeFoliar spray	
## CAS.Number111988499:Exposure.TypeFoliar spray	
## CAS.Number135410207:Exposure.TypeFoliar spray	2.50
## CAS.Number138261413:Exposure.TypeFoliar spray	2.70
## CAS.Number150824478:Exposure.TypeFoliar spray	
## CAS.Number153719234:Exposure.TypeFoliar spray	2.70
## CAS.Number165252700:Exposure.TypeFoliar spray	2.70
## CAS.Number210880925:Exposure.TypeFoliar spray	2.60
## CAS.Number105843365:Exposure.TypeFood	
## CAS.Number111988499:Exposure.TypeFood	
## CAS.Number135410207:Exposure.TypeFood	
## CAS.Number138261413:Exposure.TypeFood	1.12
## CAS.Number150824478:Exposure.TypeFood	3.87
## CAS.Number153719234:Exposure.TypeFood	1.12
## CAS.Number165252700:Exposure.TypeFood	1.12
## CAS.Number210880925:Exposure.TypeFood	
## CAS.Number105843365:Exposure.TypeGround granular	
## CAS.Number111988499:Exposure.TypeGround granular	
## CAS.Number135410207:Exposure.TypeGround granular	
## CAS.Number138261413:Exposure.TypeGround granular	0.00
## CAS.Number150824478:Exposure.TypeGround granular	
## CAS.Number153719234:Exposure.TypeGround granular	
## CAS.Number165252700:Exposure.TypeGround granular	
## CAS.Number210880925:Exposure.TypeGround granular	
## CAS.Number105843365:Exposure.TypeGround spray	
## CAS.Number111988499:Exposure.TypeGround spray	
## CAS.Number135410207:Exposure.TypeGround spray	-1.32
## CAS.Number138261413:Exposure.TypeGround spray	-5.02
## CAS.Number150824478:Exposure.TypeGround spray	
## CAS.Number153719234:Exposure.TypeGround spray	0.00
## CAS.Number165252700:Exposure.TypeGround spray	
## CAS.Number210880925:Exposure.TypeGround spray	
## CAS.Number105843365:Exposure.TypeHand spray	
## CAS.Number111988499:Exposure.TypeHand spray	6.43
## CAS.Number135410207:Exposure.TypeHand spray	-7.40
## CAS.Number138261413:Exposure.TypeHand spray	1.12
## CAS.Number150824478:Exposure.TypeHand spray	
## CAS.Number153719234:Exposure.TypeHand spray	1.12
## CAS.Number165252700:Exposure.TypeHand spray	1.12
## CAS.Number210880925:Exposure.TypeHand spray	

## CAS.Number105843365:Exposure.TypeImmersion	
## CAS.Number111988499:Exposure.TypeImmersion	
## CAS.Number135410207:Exposure.TypeImmersion	
## CAS.Number138261413:Exposure.TypeImmersion	
## CAS.Number150824478:Exposure.TypeImmersion	
## CAS.Number153719234:Exposure.TypeImmersion	
## CAS.Number165252700:Exposure.TypeImmersion	
## CAS.Number210880925:Exposure.TypeImmersion	
## CAS.Number105843365:Exposure.TypeMisted	
## CAS.Number111988499:Exposure.TypeMisted	
## CAS.Number135410207:Exposure.TypeMisted	-1.32
## CAS.Number138261413:Exposure.TypeMisted	
## CAS.Number150824478:Exposure.TypeMisted	
## CAS.Number153719234:Exposure.TypeMisted	
## CAS.Number165252700:Exposure.TypeMisted	
## CAS.Number210880925:Exposure.TypeMisted	
## CAS.Number105843365:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number111988499:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number135410207:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number138261413:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number150824478:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number153719234:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number165252700:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number210880925:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number105843365:Exposure.TypePresent in soil	
## CAS.Number111988499:Exposure.TypePresent in soil	
## CAS.Number135410207:Exposure.TypePresent in soil	
## CAS.Number138261413:Exposure.TypePresent in soil	
## CAS.Number150824478:Exposure.TypePresent in soil	
## CAS.Number153719234:Exposure.TypePresent in soil	
## CAS.Number165252700:Exposure.TypePresent in soil	
## CAS.Number210880925:Exposure.TypePresent in soil	
## CAS.Number105843365:Exposure.TypeSpray	
## CAS.Number111988499:Exposure.TypeSpray	8.32
## CAS.Number135410207:Exposure.TypeSpray	1.08
## CAS.Number138261413:Exposure.TypeSpray	1.54
## CAS.Number150824478:Exposure.TypeSpray	
## CAS.Number153719234:Exposure.TypeSpray	1.54
## CAS.Number165252700:Exposure.TypeSpray	1.54
## CAS.Number210880925:Exposure.TypeSpray	1.23
## CAS.Number105843365:Exposure.TypeTopical, general	
## CAS.Number111988499:Exposure.TypeTopical, general	1.96
## CAS.Number135410207:Exposure.TypeTopical, general	-8.19
## CAS.Number138261413:Exposure.TypeTopical, general	-8.13
## CAS.Number150824478:Exposure.TypeTopical, general	

## CAS.Number153719234:Exposure.TypeTopical, general	-8.13
## CAS.Number165252700:Exposure.TypeTopical, general	-8.13
## CAS.Number210880925:Exposure.TypeTopical, general	
## CAS.Number105843365:Exposure.TypeWatered	
## CAS.Number111988499:Exposure.TypeWatered	
## CAS.Number135410207:Exposure.TypeWatered	
## CAS.Number138261413:Exposure.TypeWatered	-1.00
## CAS.Number150824478:Exposure.TypeWatered	
## CAS.Number153719234:Exposure.TypeWatered	
## CAS.Number165252700:Exposure.TypeWatered	
## CAS.Number210880925:Exposure.TypeWatered	
##	Pr(>
## (Intercept)	0.
## CAS.Number105843365	<2e
## CAS.Number111988499	0.
## CAS.Number135410207	0.
## CAS.Number138261413	0.
## CAS.Number150824478	0.
## CAS.Number153719234	0.
## CAS.Number165252700	0.
## CAS.Number210880925	0.
## Exposure.TypeDiet, unspecified	0.
## Exposure.TypeDipped or soaked	1.
## Exposure.TypeDirect application	0.
## Exposure.TypeDrinking water	0.
## Exposure.TypeEnvironmental, unspecified	0.
## Exposure.TypeFilmcoating	1.
## Exposure.TypeFoliar spray	0.
## Exposure.TypeFood	0.
## Exposure.TypeGround granular	1.
## Exposure.TypeGround spray	1.
## Exposure.TypeHand spray	0.
## Exposure.TypeImmersion	1.
## Exposure.TypeMisted	1.
## Exposure.TypeMultiple routes within environmental exposures	1.
## Exposure.TypePresent in soil	1.
## Exposure.TypeSpray	0.
## Exposure.TypeTopical, general	0.
## Exposure.TypeWatered	<2e
## CAS.Number105843365:Exposure.TypeDiet, unspecified	
## CAS.Number111988499:Exposure.TypeDiet, unspecified	
## CAS.Number135410207:Exposure.TypeDiet, unspecified	<2e
## CAS.Number138261413:Exposure.TypeDiet, unspecified	0.
## CAS.Number150824478:Exposure.TypeDiet, unspecified	<2e
## CAS.Number153719234:Exposure.TypeDiet, unspecified	

## CAS.Number165252700:Exposure.TypeDiet, unspecified	
## CAS.Number210880925:Exposure.TypeDiet, unspecified	<2e
## CAS.Number105843365:Exposure.TypeDipped or soaked	
## CAS.Number111988499:Exposure.TypeDipped or soaked	<2e
## CAS.Number135410207:Exposure.TypeDipped or soaked	0.
## CAS.Number138261413:Exposure.TypeDipped or soaked	1.
## CAS.Number150824478:Exposure.TypeDipped or soaked	0.
## CAS.Number153719234:Exposure.TypeDipped or soaked	1.
## CAS.Number165252700:Exposure.TypeDipped or soaked	
## CAS.Number210880925:Exposure.TypeDipped or soaked	
## CAS.Number105843365:Exposure.TypeDirect application	
## CAS.Number111988499:Exposure.TypeDirect application	
## CAS.Number135410207:Exposure.TypeDirect application	0.
## CAS.Number138261413:Exposure.TypeDirect application	0.
## CAS.Number150824478:Exposure.TypeDirect application	
## CAS.Number153719234:Exposure.TypeDirect application	0.
## CAS.Number165252700:Exposure.TypeDirect application	0.
## CAS.Number210880925:Exposure.TypeDirect application	
## CAS.Number105843365:Exposure.TypeDrinking water	
## CAS.Number111988499:Exposure.TypeDrinking water	
## CAS.Number135410207:Exposure.TypeDrinking water	
## CAS.Number138261413:Exposure.TypeDrinking water	0.
## CAS.Number150824478:Exposure.TypeDrinking water	
## CAS.Number153719234:Exposure.TypeDrinking water	<2e
## CAS.Number165252700:Exposure.TypeDrinking water	
## CAS.Number210880925:Exposure.TypeDrinking water	
## CAS.Number105843365:Exposure.TypeEnvironmental, unspecified	
## CAS.Number111988499:Exposure.TypeEnvironmental, unspecified	0.
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	0.
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	0.
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	0.
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	0.
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	0.
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	
## CAS.Number105843365:Exposure.TypeFilmcoating	
## CAS.Number111988499:Exposure.TypeFilmcoating	
## CAS.Number135410207:Exposure.TypeFilmcoating	
## CAS.Number138261413:Exposure.TypeFilmcoating	
## CAS.Number150824478:Exposure.TypeFilmcoating	
## CAS.Number153719234:Exposure.TypeFilmcoating	
## CAS.Number165252700:Exposure.TypeFilmcoating	
## CAS.Number210880925:Exposure.TypeFilmcoating	
## CAS.Number105843365:Exposure.TypeFoliar spray	
## CAS.Number111988499:Exposure.TypeFoliar spray	
## CAS.Number135410207:Exposure.TypeFoliar spray	0.

## CAS.Number138261413:Exposure.TypeFoliar	spray	0.
## CAS.Number150824478:Exposure.TypeFoliar	spray	
## CAS.Number153719234:Exposure.TypeFoliar	spray	0.
## CAS.Number165252700:Exposure.TypeFoliar	spray	0.
## CAS.Number210880925:Exposure.TypeFoliar	spray	0.
## CAS.Number105843365:Exposure.TypeFood		
## CAS.Number111988499:Exposure.TypeFood		
## CAS.Number135410207:Exposure.TypeFood		
## CAS.Number138261413:Exposure.TypeFood		0.
## CAS.Number150824478:Exposure.TypeFood		0.
## CAS.Number153719234:Exposure.TypeFood		0.
## CAS.Number165252700:Exposure.TypeFood		0.
## CAS.Number210880925:Exposure.TypeFood		
## CAS.Number105843365:Exposure.TypeGround	granular	
## CAS.Number111988499:Exposure.TypeGround	granular	
## CAS.Number135410207:Exposure.TypeGround	granular	
## CAS.Number138261413:Exposure.TypeGround	granular	1.
## CAS.Number150824478:Exposure.TypeGround	granular	
## CAS.Number153719234:Exposure.TypeGround	granular	
## CAS.Number165252700:Exposure.TypeGround	granular	
## CAS.Number210880925:Exposure.TypeGround	granular	
## CAS.Number105843365:Exposure.TypeGround	spray	
## CAS.Number111988499:Exposure.TypeGround	spray	
## CAS.Number135410207:Exposure.TypeGround	spray	0.
## CAS.Number138261413:Exposure.TypeGround	spray	<2e
## CAS.Number150824478:Exposure.TypeGround	spray	
## CAS.Number153719234:Exposure.TypeGround	spray	1.
## CAS.Number165252700:Exposure.TypeGround	spray	
## CAS.Number210880925:Exposure.TypeGround	spray	
## CAS.Number105843365:Exposure.TypeHand	spray	
## CAS.Number111988499:Exposure.TypeHand	spray	0.
## CAS.Number135410207:Exposure.TypeHand	spray	0.
## CAS.Number138261413:Exposure.TypeHand	spray	0.
## CAS.Number150824478:Exposure.TypeHand	spray	
## CAS.Number153719234:Exposure.TypeHand	spray	0.
## CAS.Number165252700:Exposure.TypeHand	spray	0.
## CAS.Number210880925:Exposure.TypeHand	spray	
## CAS.Number105843365:Exposure.TypeImmersion		
## CAS.Number111988499:Exposure.TypeImmersion		
## CAS.Number135410207:Exposure.TypeImmersion		
## CAS.Number138261413:Exposure.TypeImmersion		
## CAS.Number150824478:Exposure.TypeImmersion		
## CAS.Number153719234:Exposure.TypeImmersion		
## CAS.Number165252700:Exposure.TypeImmersion		
## CAS.Number210880925:Exposure.TypeImmersion		

## CAS.Number105843365:Exposure.TypeMisted	
## CAS.Number111988499:Exposure.TypeMisted	
## CAS.Number135410207:Exposure.TypeMisted	0.
## CAS.Number138261413:Exposure.TypeMisted	
## CAS.Number150824478:Exposure.TypeMisted	
## CAS.Number153719234:Exposure.TypeMisted	
## CAS.Number165252700:Exposure.TypeMisted	
## CAS.Number210880925:Exposure.TypeMisted	
## CAS.Number105843365:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number111988499:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number135410207:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number138261413:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number150824478:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number153719234:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number165252700:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number210880925:Exposure.TypeMultiple routes within environmental exposures	
## CAS.Number105843365:Exposure.TypePresent in soil	
## CAS.Number111988499:Exposure.TypePresent in soil	
## CAS.Number135410207:Exposure.TypePresent in soil	
## CAS.Number138261413:Exposure.TypePresent in soil	
## CAS.Number150824478:Exposure.TypePresent in soil	
## CAS.Number153719234:Exposure.TypePresent in soil	
## CAS.Number165252700:Exposure.TypePresent in soil	
## CAS.Number210880925:Exposure.TypePresent in soil	
## CAS.Number105843365:Exposure.TypeSpray	
## CAS.Number111988499:Exposure.TypeSpray	0.
## CAS.Number135410207:Exposure.TypeSpray	0.
## CAS.Number138261413:Exposure.TypeSpray	0.
## CAS.Number150824478:Exposure.TypeSpray	
## CAS.Number153719234:Exposure.TypeSpray	0.
## CAS.Number165252700:Exposure.TypeSpray	0.
## CAS.Number210880925:Exposure.TypeSpray	0.
## CAS.Number105843365:Exposure.TypeTopical, general	
## CAS.Number111988499:Exposure.TypeTopical, general	<2e
## CAS.Number135410207:Exposure.TypeTopical, general	0.
## CAS.Number138261413:Exposure.TypeTopical, general	0.
## CAS.Number150824478:Exposure.TypeTopical, general	
## CAS.Number153719234:Exposure.TypeTopical, general	0.
## CAS.Number165252700:Exposure.TypeTopical, general	0.
## CAS.Number210880925:Exposure.TypeTopical, general	
## CAS.Number105843365:Exposure.TypeWatered	
## CAS.Number111988499:Exposure.TypeWatered	
## CAS.Number135410207:Exposure.TypeWatered	
## CAS.Number138261413:Exposure.TypeWatered	0.
## CAS.Number150824478:Exposure.TypeWatered	

```

## CAS.Number153719234:Exposure.TypeWatered
## CAS.Number165252700:Exposure.TypeWatered
## CAS.Number210880925:Exposure.TypeWatered
##
## (Intercept)
## CAS.Number105843365 ***
## CAS.Number111988499
## CAS.Number135410207
## CAS.Number138261413
## CAS.Number150824478
## CAS.Number153719234
## CAS.Number165252700
## CAS.Number210880925
## Exposure.TypeDiet, unspecified
## Exposure.TypeDipped or soaked
## Exposure.TypeDirect application
## Exposure.TypeDrinking water
## Exposure.TypeEnvironmental, unspecified
## Exposure.TypeFilmcoating
## Exposure.TypeFoliar spray
## Exposure.TypeFood
## Exposure.TypeGround granular
## Exposure.TypeGround spray
## Exposure.TypeHand spray
## Exposure.TypeImmersion
## Exposure.TypeMisted
## Exposure.TypeMultiple routes within environmental exposures
## Exposure.TypePresent in soil
## Exposure.TypeSpray
## Exposure.TypeTopical, general
## Exposure.TypeWatered ***
## CAS.Number105843365:Exposure.TypeDiet, unspecified
## CAS.Number111988499:Exposure.TypeDiet, unspecified
## CAS.Number135410207:Exposure.TypeDiet, unspecified ***
## CAS.Number138261413:Exposure.TypeDiet, unspecified
## CAS.Number150824478:Exposure.TypeDiet, unspecified ***
## CAS.Number153719234:Exposure.TypeDiet, unspecified
## CAS.Number165252700:Exposure.TypeDiet, unspecified
## CAS.Number210880925:Exposure.TypeDiet, unspecified ***
## CAS.Number105843365:Exposure.TypeDipped or soaked
## CAS.Number111988499:Exposure.TypeDipped or soaked ***
## CAS.Number135410207:Exposure.TypeDipped or soaked
## CAS.Number138261413:Exposure.TypeDipped or soaked
## CAS.Number150824478:Exposure.TypeDipped or soaked
## CAS.Number153719234:Exposure.TypeDipped or soaked

```

CAS.Number165252700:Exposure.TypeDipped or soaked
 ## CAS.Number210880925:Exposure.TypeDipped or soaked
 ## CAS.Number105843365:Exposure.TypeDirect application
 ## CAS.Number111988499:Exposure.TypeDirect application
 ## CAS.Number135410207:Exposure.TypeDirect application
 ## CAS.Number138261413:Exposure.TypeDirect application
 ## CAS.Number150824478:Exposure.TypeDirect application
 ## CAS.Number153719234:Exposure.TypeDirect application
 ## CAS.Number165252700:Exposure.TypeDirect application
 ## CAS.Number210880925:Exposure.TypeDirect application
 ## CAS.Number105843365:Exposure.TypeDrinking water
 ## CAS.Number111988499:Exposure.TypeDrinking water
 ## CAS.Number135410207:Exposure.TypeDrinking water
 ## CAS.Number138261413:Exposure.TypeDrinking water
 ## CAS.Number150824478:Exposure.TypeDrinking water
 ## CAS.Number153719234:Exposure.TypeDrinking water
 ## CAS.Number165252700:Exposure.TypeDrinking water
 ## CAS.Number210880925:Exposure.TypeDrinking water
 ## CAS.Number105843365:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number111988499:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified
 ## CAS.Number105843365:Exposure.TypeFilmcoating
 ## CAS.Number111988499:Exposure.TypeFilmcoating
 ## CAS.Number135410207:Exposure.TypeFilmcoating
 ## CAS.Number138261413:Exposure.TypeFilmcoating
 ## CAS.Number150824478:Exposure.TypeFilmcoating
 ## CAS.Number153719234:Exposure.TypeFilmcoating
 ## CAS.Number165252700:Exposure.TypeFilmcoating
 ## CAS.Number210880925:Exposure.TypeFilmcoating
 ## CAS.Number105843365:Exposure.TypeFoliar spray
 ## CAS.Number111988499:Exposure.TypeFoliar spray
 ## CAS.Number135410207:Exposure.TypeFoliar spray
 ## CAS.Number138261413:Exposure.TypeFoliar spray
 ## CAS.Number150824478:Exposure.TypeFoliar spray
 ## CAS.Number153719234:Exposure.TypeFoliar spray
 ## CAS.Number165252700:Exposure.TypeFoliar spray
 ## CAS.Number210880925:Exposure.TypeFoliar spray
 ## CAS.Number105843365:Exposure.TypeFood
 ## CAS.Number111988499:Exposure.TypeFood
 ## CAS.Number135410207:Exposure.TypeFood

CAS.Number138261413:Exposure.TypeFood
CAS.Number150824478:Exposure.TypeFood
CAS.Number153719234:Exposure.TypeFood
CAS.Number165252700:Exposure.TypeFood
CAS.Number210880925:Exposure.TypeFood
CAS.Number105843365:Exposure.TypeGround granular
CAS.Number111988499:Exposure.TypeGround granular
CAS.Number135410207:Exposure.TypeGround granular
CAS.Number138261413:Exposure.TypeGround granular
CAS.Number150824478:Exposure.TypeGround granular
CAS.Number153719234:Exposure.TypeGround granular
CAS.Number165252700:Exposure.TypeGround granular
CAS.Number210880925:Exposure.TypeGround granular
CAS.Number105843365:Exposure.TypeGround spray
CAS.Number111988499:Exposure.TypeGround spray
CAS.Number135410207:Exposure.TypeGround spray
CAS.Number138261413:Exposure.TypeGround spray
CAS.Number150824478:Exposure.TypeGround spray
CAS.Number153719234:Exposure.TypeGround spray
CAS.Number165252700:Exposure.TypeGround spray
CAS.Number210880925:Exposure.TypeGround spray
CAS.Number105843365:Exposure.TypeHand spray
CAS.Number111988499:Exposure.TypeHand spray
CAS.Number135410207:Exposure.TypeHand spray
CAS.Number138261413:Exposure.TypeHand spray
CAS.Number150824478:Exposure.TypeHand spray
CAS.Number153719234:Exposure.TypeHand spray
CAS.Number165252700:Exposure.TypeHand spray
CAS.Number210880925:Exposure.TypeHand spray
CAS.Number105843365:Exposure.TypeImmersion
CAS.Number111988499:Exposure.TypeImmersion
CAS.Number135410207:Exposure.TypeImmersion
CAS.Number138261413:Exposure.TypeImmersion
CAS.Number150824478:Exposure.TypeImmersion
CAS.Number153719234:Exposure.TypeImmersion
CAS.Number165252700:Exposure.TypeImmersion
CAS.Number210880925:Exposure.TypeImmersion
CAS.Number105843365:Exposure.TypeMisted
CAS.Number111988499:Exposure.TypeMisted
CAS.Number135410207:Exposure.TypeMisted
CAS.Number138261413:Exposure.TypeMisted
CAS.Number150824478:Exposure.TypeMisted
CAS.Number153719234:Exposure.TypeMisted
CAS.Number165252700:Exposure.TypeMisted
CAS.Number210880925:Exposure.TypeMisted

```

## CAS.Number105843365:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number111988499:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number135410207:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number138261413:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number150824478:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number153719234:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number165252700:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number210880925:Exposure.TypeMultiple routes within environmental exposures
## CAS.Number105843365:Exposure.TypePresent in soil
## CAS.Number111988499:Exposure.TypePresent in soil
## CAS.Number135410207:Exposure.TypePresent in soil
## CAS.Number138261413:Exposure.TypePresent in soil
## CAS.Number150824478:Exposure.TypePresent in soil
## CAS.Number153719234:Exposure.TypePresent in soil
## CAS.Number165252700:Exposure.TypePresent in soil
## CAS.Number210880925:Exposure.TypePresent in soil
## CAS.Number105843365:Exposure.TypeSpray
## CAS.Number111988499:Exposure.TypeSpray
## CAS.Number135410207:Exposure.TypeSpray
## CAS.Number138261413:Exposure.TypeSpray
## CAS.Number150824478:Exposure.TypeSpray
## CAS.Number153719234:Exposure.TypeSpray
## CAS.Number165252700:Exposure.TypeSpray
## CAS.Number210880925:Exposure.TypeSpray
## CAS.Number105843365:Exposure.TypeTopical, general
## CAS.Number111988499:Exposure.TypeTopical, general
## CAS.Number135410207:Exposure.TypeTopical, general
## CAS.Number138261413:Exposure.TypeTopical, general
## CAS.Number150824478:Exposure.TypeTopical, general
## CAS.Number153719234:Exposure.TypeTopical, general
## CAS.Number165252700:Exposure.TypeTopical, general
## CAS.Number210880925:Exposure.TypeTopical, general
## CAS.Number105843365:Exposure.TypeWatered
## CAS.Number111988499:Exposure.TypeWatered
## CAS.Number135410207:Exposure.TypeWatered
## CAS.Number138261413:Exposure.TypeWatered
## CAS.Number150824478:Exposure.TypeWatered
## CAS.Number153719234:Exposure.TypeWatered
## CAS.Number165252700:Exposure.TypeWatered
## CAS.Number210880925:Exposure.TypeWatered
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##

```

```

##      Null deviance: 3233.2  on 2528  degrees of freedom
## Residual deviance: 2353.3  on 2450  degrees of freedom
## AIC: 2511.3
##
## Number of Fisher Scoring iterations: 25
logit6 <- glm(Mortality ~ CAS.Number * Exposure.Type, data = BeeMortalityExposureType, f

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
summary(logit6)

##
## Call:
## glm(formula = Mortality ~ CAS.Number * Exposure.Type, family = "binomial",
##      data = BeeMortalityExposureType)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -8.49      0.00      0.00      0.00      8.49
##
## Coefficients: (52 not defined because of singularities)
##
## (Intercept)                                -4.504e+1
## CAS.Number135410207                        1.364e+1
## CAS.Number138261413                        1.094e+1
## CAS.Number150824478                        1.372e+1
## CAS.Number153719234                       -2.252e+1
## CAS.Number165252700                       -3.002e+1
## CAS.Number210880925                       -2.252e+1
## Exposure.TypeDermal                        4.954e+1
## Exposure.TypeDiet, unspecified              3.603e+1
## Exposure.TypeDirect application            -5.147e+1
## Exposure.TypeDrinking water                3.860e+1
## Exposure.TypeDropwise                     3.860e+1
## Exposure.TypeEnvironmental, unspecified    4.955e+1
## Exposure.TypeFood                         4.504e+1
## Exposure.TypeGround granular              -5.147e+1
## Exposure.TypeHand spray                   -6.434e+1
## Exposure.TypeMultiple routes between application groups -1.930e+1
## Exposure.TypeOral via capsule              4.582e+1
## Exposure.TypeSpray                       -4.503e+1
## Exposure.TypeTopical, general              4.954e+1
## CAS.Number135410207:Exposure.TypeDermal   -5.147e+1

```

## CAS.Number138261413:Exposure.TypeDermal	-5.597e+1
## CAS.Number150824478:Exposure.TypeDermal	N
## CAS.Number153719234:Exposure.TypeDermal	-5.855e+1
## CAS.Number165252700:Exposure.TypeDermal	3.002e+1
## CAS.Number210880925:Exposure.TypeDermal	-2.252e+1
## CAS.Number135410207:Exposure.TypeDiet, unspecified	N
## CAS.Number138261413:Exposure.TypeDiet, unspecified	-4.246e+1
## CAS.Number150824478:Exposure.TypeDiet, unspecified	N
## CAS.Number153719234:Exposure.TypeDiet, unspecified	N
## CAS.Number165252700:Exposure.TypeDiet, unspecified	N
## CAS.Number210880925:Exposure.TypeDiet, unspecified	N
## CAS.Number135410207:Exposure.TypeDirect application	N
## CAS.Number138261413:Exposure.TypeDirect application	N
## CAS.Number150824478:Exposure.TypeDirect application	N
## CAS.Number153719234:Exposure.TypeDirect application	N
## CAS.Number165252700:Exposure.TypeDirect application	N
## CAS.Number210880925:Exposure.TypeDirect application	N
## CAS.Number135410207:Exposure.TypeDrinking water	N
## CAS.Number138261413:Exposure.TypeDrinking water	N
## CAS.Number150824478:Exposure.TypeDrinking water	N
## CAS.Number153719234:Exposure.TypeDrinking water	N
## CAS.Number165252700:Exposure.TypeDrinking water	N
## CAS.Number210880925:Exposure.TypeDrinking water	N
## CAS.Number135410207:Exposure.TypeDropwise	N
## CAS.Number138261413:Exposure.TypeDropwise	N
## CAS.Number150824478:Exposure.TypeDropwise	N
## CAS.Number153719234:Exposure.TypeDropwise	N
## CAS.Number165252700:Exposure.TypeDropwise	N
## CAS.Number210880925:Exposure.TypeDropwise	N
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	-5.544e+1
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	-8.287e+1
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	N
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	-3.048e+1
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	-1.878e+1
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	-1.779e+1
## CAS.Number135410207:Exposure.TypeFood	-3.941e+1
## CAS.Number138261413:Exposure.TypeFood	-4.179e+1
## CAS.Number150824478:Exposure.TypeFood	N
## CAS.Number153719234:Exposure.TypeFood	3.613e+1
## CAS.Number165252700:Exposure.TypeFood	1.678e+1
## CAS.Number210880925:Exposure.TypeFood	2.808e+1
## CAS.Number135410207:Exposure.TypeGround granular	N
## CAS.Number138261413:Exposure.TypeGround granular	N
## CAS.Number150824478:Exposure.TypeGround granular	N
## CAS.Number153719234:Exposure.TypeGround granular	N

## CAS.Number165252700:Exposure.TypeGround granular	N
## CAS.Number210880925:Exposure.TypeGround granular	N
## CAS.Number135410207:Exposure.TypeHand spray	N
## CAS.Number138261413:Exposure.TypeHand spray	N
## CAS.Number150824478:Exposure.TypeHand spray	N
## CAS.Number153719234:Exposure.TypeHand spray	N
## CAS.Number165252700:Exposure.TypeHand spray	N
## CAS.Number210880925:Exposure.TypeHand spray	N
## CAS.Number135410207:Exposure.TypeMultiple routes between application groups	N
## CAS.Number138261413:Exposure.TypeMultiple routes between application groups	N
## CAS.Number150824478:Exposure.TypeMultiple routes between application groups	N
## CAS.Number153719234:Exposure.TypeMultiple routes between application groups	N
## CAS.Number165252700:Exposure.TypeMultiple routes between application groups	N
## CAS.Number210880925:Exposure.TypeMultiple routes between application groups	N
## CAS.Number135410207:Exposure.TypeOral via capsule	4.496e+1
## CAS.Number138261413:Exposure.TypeOral via capsule	3.402e+1
## CAS.Number150824478:Exposure.TypeOral via capsule	N
## CAS.Number153719234:Exposure.TypeOral via capsule	6.748e+1
## CAS.Number165252700:Exposure.TypeOral via capsule	7.498e+1
## CAS.Number210880925:Exposure.TypeOral via capsule	6.748e+1
## CAS.Number135410207:Exposure.TypeSpray	9.006e+1
## CAS.Number138261413:Exposure.TypeSpray	-2.767e+1
## CAS.Number150824478:Exposure.TypeSpray	N
## CAS.Number153719234:Exposure.TypeSpray	N
## CAS.Number165252700:Exposure.TypeSpray	N
## CAS.Number210880925:Exposure.TypeSpray	5.855e+1
## CAS.Number135410207:Exposure.TypeTopical, general	N
## CAS.Number138261413:Exposure.TypeTopical, general	-2.917e+1
## CAS.Number150824478:Exposure.TypeTopical, general	N
## CAS.Number153719234:Exposure.TypeTopical, general	-3.811e+1
## CAS.Number165252700:Exposure.TypeTopical, general	N
## CAS.Number210880925:Exposure.TypeTopical, general	N
##	Std. Error
## (Intercept)	4.375e+0
## CAS.Number135410207	3.826e+0
## CAS.Number138261413	5.057e+0
## CAS.Number150824478	7.351e+0
## CAS.Number153719234	4.862e+0
## CAS.Number165252700	3.743e+0
## CAS.Number210880925	3.826e+0
## Exposure.TypeDermal	5.305e+0
## Exposure.TypeDiet, unspecified	3.001e+0
## Exposure.TypeDirect application	5.381e+0
## Exposure.TypeDrinking water	7.174e+0
## Exposure.TypeDropwise	7.174e+0

## Exposure.TypeEnvironmental, unspecified	8.011e+0
## Exposure.TypeFood	4.728e+0
## Exposure.TypeGround granular	3.929e+0
## Exposure.TypeHand spray	4.206e+0
## Exposure.TypeMultiple routes between application groups	3.587e+0
## Exposure.TypeOral via capsule	5.844e+0
## Exposure.TypeSpray	5.305e+0
## Exposure.TypeTopical, general	3.183e+0
## CAS.Number135410207:Exposure.TypeDermal	5.025e+0
## CAS.Number138261413:Exposure.TypeDermal	8.923e+0
## CAS.Number150824478:Exposure.TypeDermal	N
## CAS.Number153719234:Exposure.TypeDermal	5.844e+0
## CAS.Number165252700:Exposure.TypeDermal	8.250e+0
## CAS.Number210880925:Exposure.TypeDermal	8.287e+0
## CAS.Number135410207:Exposure.TypeDiet, unspecified	N
## CAS.Number138261413:Exposure.TypeDiet, unspecified	4.381e+0
## CAS.Number150824478:Exposure.TypeDiet, unspecified	N
## CAS.Number153719234:Exposure.TypeDiet, unspecified	N
## CAS.Number165252700:Exposure.TypeDiet, unspecified	N
## CAS.Number210880925:Exposure.TypeDiet, unspecified	N
## CAS.Number135410207:Exposure.TypeDirect application	N
## CAS.Number138261413:Exposure.TypeDirect application	N
## CAS.Number150824478:Exposure.TypeDirect application	N
## CAS.Number153719234:Exposure.TypeDirect application	N
## CAS.Number165252700:Exposure.TypeDirect application	N
## CAS.Number210880925:Exposure.TypeDirect application	N
## CAS.Number135410207:Exposure.TypeDrinking water	N
## CAS.Number138261413:Exposure.TypeDrinking water	N
## CAS.Number150824478:Exposure.TypeDrinking water	N
## CAS.Number153719234:Exposure.TypeDrinking water	N
## CAS.Number165252700:Exposure.TypeDrinking water	N
## CAS.Number210880925:Exposure.TypeDrinking water	N
## CAS.Number135410207:Exposure.TypeDropwise	N
## CAS.Number138261413:Exposure.TypeDropwise	N
## CAS.Number150824478:Exposure.TypeDropwise	N
## CAS.Number153719234:Exposure.TypeDropwise	N
## CAS.Number165252700:Exposure.TypeDropwise	N
## CAS.Number210880925:Exposure.TypeDropwise	N
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	7.946e+0
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	8.467e+0
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	N
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	8.367e+0
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	7.925e+0
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	7.801e+0
## CAS.Number135410207:Exposure.TypeFood	4.389e+0

## CAS.Number138261413:Exposure.TypeFood	5.373e+0
## CAS.Number150824478:Exposure.TypeFood	N
## CAS.Number153719234:Exposure.TypeFood	5.214e+0
## CAS.Number165252700:Exposure.TypeFood	4.458e+0
## CAS.Number210880925:Exposure.TypeFood	4.258e+0
## CAS.Number135410207:Exposure.TypeGround granular	N
## CAS.Number138261413:Exposure.TypeGround granular	N
## CAS.Number150824478:Exposure.TypeGround granular	N
## CAS.Number153719234:Exposure.TypeGround granular	N
## CAS.Number165252700:Exposure.TypeGround granular	N
## CAS.Number210880925:Exposure.TypeGround granular	N
## CAS.Number135410207:Exposure.TypeHand spray	N
## CAS.Number138261413:Exposure.TypeHand spray	N
## CAS.Number150824478:Exposure.TypeHand spray	N
## CAS.Number153719234:Exposure.TypeHand spray	N
## CAS.Number165252700:Exposure.TypeHand spray	N
## CAS.Number210880925:Exposure.TypeHand spray	N
## CAS.Number135410207:Exposure.TypeMultiple routes between application groups	N
## CAS.Number138261413:Exposure.TypeMultiple routes between application groups	N
## CAS.Number150824478:Exposure.TypeMultiple routes between application groups	N
## CAS.Number153719234:Exposure.TypeMultiple routes between application groups	N
## CAS.Number165252700:Exposure.TypeMultiple routes between application groups	N
## CAS.Number210880925:Exposure.TypeMultiple routes between application groups	N
## CAS.Number135410207:Exposure.TypeOral via capsule	6.396e+0
## CAS.Number138261413:Exposure.TypeOral via capsule	7.944e+0
## CAS.Number150824478:Exposure.TypeOral via capsule	N
## CAS.Number153719234:Exposure.TypeOral via capsule	7.821e+0
## CAS.Number165252700:Exposure.TypeOral via capsule	6.044e+0
## CAS.Number210880925:Exposure.TypeOral via capsule	7.223e+0
## CAS.Number135410207:Exposure.TypeSpray	8.287e+0
## CAS.Number138261413:Exposure.TypeSpray	6.060e+0
## CAS.Number150824478:Exposure.TypeSpray	N
## CAS.Number153719234:Exposure.TypeSpray	N
## CAS.Number165252700:Exposure.TypeSpray	N
## CAS.Number210880925:Exposure.TypeSpray	5.305e+0
## CAS.Number135410207:Exposure.TypeTopical, general	N
## CAS.Number138261413:Exposure.TypeTopical, general	4.200e+0
## CAS.Number150824478:Exposure.TypeTopical, general	N
## CAS.Number153719234:Exposure.TypeTopical, general	4.046e+0
## CAS.Number165252700:Exposure.TypeTopical, general	N
## CAS.Number210880925:Exposure.TypeTopical, general	N
##	z valu
## (Intercept)	-1029513
## CAS.Number135410207	356
## CAS.Number138261413	2162870

## CAS.Number150824478	186
## CAS.Number153719234	-4630852
## CAS.Number165252700	-8020675
## CAS.Number210880925	-5885710
## Exposure.TypeDermal	9337593
## Exposure.TypeDiet, unspecified	12004798
## Exposure.TypeDirect application	-9565652
## Exposure.TypeDrinking water	5380679
## Exposure.TypeDropwise	5380679
## Exposure.TypeEnvironmental, unspecified	6185456
## Exposure.TypeFood	952473
## Exposure.TypeGround granular	-13098309
## Exposure.TypeHand spray	-1529553
## Exposure.TypeMultiple routes between application groups	-5380679
## Exposure.TypeOral via capsule	783998
## Exposure.TypeSpray	-848833
## Exposure.TypeTopical, general	15562290
## CAS.Number135410207:Exposure.TypeDermal	-10242609
## CAS.Number138261413:Exposure.TypeDermal	-6273060
## CAS.Number150824478:Exposure.TypeDermal	N
## CAS.Number153719234:Exposure.TypeDermal	-10018322
## CAS.Number165252700:Exposure.TypeDermal	3639349
## CAS.Number210880925:Exposure.TypeDermal	-2717188
## CAS.Number135410207:Exposure.TypeDiet, unspecified	N
## CAS.Number138261413:Exposure.TypeDiet, unspecified	-9692234
## CAS.Number150824478:Exposure.TypeDiet, unspecified	N
## CAS.Number153719234:Exposure.TypeDiet, unspecified	N
## CAS.Number165252700:Exposure.TypeDiet, unspecified	N
## CAS.Number210880925:Exposure.TypeDiet, unspecified	N
## CAS.Number135410207:Exposure.TypeDirect application	N
## CAS.Number138261413:Exposure.TypeDirect application	N
## CAS.Number150824478:Exposure.TypeDirect application	N
## CAS.Number153719234:Exposure.TypeDirect application	N
## CAS.Number165252700:Exposure.TypeDirect application	N
## CAS.Number210880925:Exposure.TypeDirect application	N
## CAS.Number135410207:Exposure.TypeDrinking water	N
## CAS.Number138261413:Exposure.TypeDrinking water	N
## CAS.Number150824478:Exposure.TypeDrinking water	N
## CAS.Number153719234:Exposure.TypeDrinking water	N
## CAS.Number165252700:Exposure.TypeDrinking water	N
## CAS.Number210880925:Exposure.TypeDrinking water	N
## CAS.Number135410207:Exposure.TypeDropwise	N
## CAS.Number138261413:Exposure.TypeDropwise	N
## CAS.Number150824478:Exposure.TypeDropwise	N
## CAS.Number153719234:Exposure.TypeDropwise	N

## CAS.Number165252700:Exposure.TypeDropwise	N
## CAS.Number210880925:Exposure.TypeDropwise	N
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	-6977449
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	-9787516
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	N
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	-3642664
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	-2369572
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	-2280375
## CAS.Number135410207:Exposure.TypeFood	-8979230
## CAS.Number138261413:Exposure.TypeFood	-7779175
## CAS.Number150824478:Exposure.TypeFood	N
## CAS.Number153719234:Exposure.TypeFood	6928783
## CAS.Number165252700:Exposure.TypeFood	3763066
## CAS.Number210880925:Exposure.TypeFood	6593991
## CAS.Number135410207:Exposure.TypeGround granular	N
## CAS.Number138261413:Exposure.TypeGround granular	N
## CAS.Number150824478:Exposure.TypeGround granular	N
## CAS.Number153719234:Exposure.TypeGround granular	N
## CAS.Number165252700:Exposure.TypeGround granular	N
## CAS.Number210880925:Exposure.TypeGround granular	N
## CAS.Number135410207:Exposure.TypeHand spray	N
## CAS.Number138261413:Exposure.TypeHand spray	N
## CAS.Number150824478:Exposure.TypeHand spray	N
## CAS.Number153719234:Exposure.TypeHand spray	N
## CAS.Number165252700:Exposure.TypeHand spray	N
## CAS.Number210880925:Exposure.TypeHand spray	N
## CAS.Number135410207:Exposure.TypeMultiple routes between application groups	N
## CAS.Number138261413:Exposure.TypeMultiple routes between application groups	N
## CAS.Number150824478:Exposure.TypeMultiple routes between application groups	N
## CAS.Number153719234:Exposure.TypeMultiple routes between application groups	N
## CAS.Number165252700:Exposure.TypeMultiple routes between application groups	N
## CAS.Number210880925:Exposure.TypeMultiple routes between application groups	N
## CAS.Number135410207:Exposure.TypeOral via capsule	7029023
## CAS.Number138261413:Exposure.TypeOral via capsule	4282658
## CAS.Number150824478:Exposure.TypeOral via capsule	N
## CAS.Number153719234:Exposure.TypeOral via capsule	8627116
## CAS.Number165252700:Exposure.TypeOral via capsule	12405985
## CAS.Number210880925:Exposure.TypeOral via capsule	9342262
## CAS.Number135410207:Exposure.TypeSpray	1086733
## CAS.Number138261413:Exposure.TypeSpray	-4565071
## CAS.Number150824478:Exposure.TypeSpray	N
## CAS.Number153719234:Exposure.TypeSpray	N
## CAS.Number165252700:Exposure.TypeSpray	N
## CAS.Number210880925:Exposure.TypeSpray	11035241
## CAS.Number135410207:Exposure.TypeTopical, general	N

## CAS.Number138261413:Exposure.TypeTopical, general	-6944292
## CAS.Number150824478:Exposure.TypeTopical, general	N
## CAS.Number153719234:Exposure.TypeTopical, general	-9418677
## CAS.Number165252700:Exposure.TypeTopical, general	N
## CAS.Number210880925:Exposure.TypeTopical, general	N
##	Pr(> z)
## (Intercept)	<2e-16
## CAS.Number135410207	<2e-16
## CAS.Number138261413	<2e-16
## CAS.Number150824478	<2e-16
## CAS.Number153719234	<2e-16
## CAS.Number165252700	<2e-16
## CAS.Number210880925	<2e-16
## Exposure.TypeDermal	<2e-16
## Exposure.TypeDiet, unspecified	<2e-16
## Exposure.TypeDirect application	<2e-16
## Exposure.TypeDrinking water	<2e-16
## Exposure.TypeDropwise	<2e-16
## Exposure.TypeEnvironmental, unspecified	<2e-16
## Exposure.TypeFood	<2e-16
## Exposure.TypeGround granular	<2e-16
## Exposure.TypeHand spray	<2e-16
## Exposure.TypeMultiple routes between application groups	<2e-16
## Exposure.TypeOral via capsule	<2e-16
## Exposure.TypeSpray	<2e-16
## Exposure.TypeTopical, general	<2e-16
## CAS.Number135410207:Exposure.TypeDermal	<2e-16
## CAS.Number138261413:Exposure.TypeDermal	<2e-16
## CAS.Number150824478:Exposure.TypeDermal	NA
## CAS.Number153719234:Exposure.TypeDermal	<2e-16
## CAS.Number165252700:Exposure.TypeDermal	<2e-16
## CAS.Number210880925:Exposure.TypeDermal	<2e-16
## CAS.Number135410207:Exposure.TypeDiet, unspecified	NA
## CAS.Number138261413:Exposure.TypeDiet, unspecified	<2e-16
## CAS.Number150824478:Exposure.TypeDiet, unspecified	NA
## CAS.Number153719234:Exposure.TypeDiet, unspecified	NA
## CAS.Number165252700:Exposure.TypeDiet, unspecified	NA
## CAS.Number210880925:Exposure.TypeDiet, unspecified	NA
## CAS.Number135410207:Exposure.TypeDirect application	NA
## CAS.Number138261413:Exposure.TypeDirect application	NA
## CAS.Number150824478:Exposure.TypeDirect application	NA
## CAS.Number153719234:Exposure.TypeDirect application	NA
## CAS.Number165252700:Exposure.TypeDirect application	NA
## CAS.Number210880925:Exposure.TypeDirect application	NA
## CAS.Number135410207:Exposure.TypeDrinking water	NA

## CAS.Number138261413:Exposure.TypeDrinking water	NA
## CAS.Number150824478:Exposure.TypeDrinking water	NA
## CAS.Number153719234:Exposure.TypeDrinking water	NA
## CAS.Number165252700:Exposure.TypeDrinking water	NA
## CAS.Number210880925:Exposure.TypeDrinking water	NA
## CAS.Number135410207:Exposure.TypeDropwise	NA
## CAS.Number138261413:Exposure.TypeDropwise	NA
## CAS.Number150824478:Exposure.TypeDropwise	NA
## CAS.Number153719234:Exposure.TypeDropwise	NA
## CAS.Number165252700:Exposure.TypeDropwise	NA
## CAS.Number210880925:Exposure.TypeDropwise	NA
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified	<2e-16
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified	<2e-16
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified	NA
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified	<2e-16
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified	<2e-16
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified	<2e-16
## CAS.Number135410207:Exposure.TypeFood	<2e-16
## CAS.Number138261413:Exposure.TypeFood	<2e-16
## CAS.Number150824478:Exposure.TypeFood	NA
## CAS.Number153719234:Exposure.TypeFood	<2e-16
## CAS.Number165252700:Exposure.TypeFood	<2e-16
## CAS.Number210880925:Exposure.TypeFood	<2e-16
## CAS.Number135410207:Exposure.TypeGround granular	NA
## CAS.Number138261413:Exposure.TypeGround granular	NA
## CAS.Number150824478:Exposure.TypeGround granular	NA
## CAS.Number153719234:Exposure.TypeGround granular	NA
## CAS.Number165252700:Exposure.TypeGround granular	NA
## CAS.Number210880925:Exposure.TypeGround granular	NA
## CAS.Number135410207:Exposure.TypeHand spray	NA
## CAS.Number138261413:Exposure.TypeHand spray	NA
## CAS.Number150824478:Exposure.TypeHand spray	NA
## CAS.Number153719234:Exposure.TypeHand spray	NA
## CAS.Number165252700:Exposure.TypeHand spray	NA
## CAS.Number210880925:Exposure.TypeHand spray	NA
## CAS.Number135410207:Exposure.TypeMultiple routes between application groups	NA
## CAS.Number138261413:Exposure.TypeMultiple routes between application groups	NA
## CAS.Number150824478:Exposure.TypeMultiple routes between application groups	NA
## CAS.Number153719234:Exposure.TypeMultiple routes between application groups	NA
## CAS.Number165252700:Exposure.TypeMultiple routes between application groups	NA
## CAS.Number210880925:Exposure.TypeMultiple routes between application groups	NA
## CAS.Number135410207:Exposure.TypeOral via capsule	<2e-16
## CAS.Number138261413:Exposure.TypeOral via capsule	<2e-16
## CAS.Number150824478:Exposure.TypeOral via capsule	NA
## CAS.Number153719234:Exposure.TypeOral via capsule	<2e-16

```

## CAS.Number165252700:Exposure.TypeOral via capsule <2e-16
## CAS.Number210880925:Exposure.TypeOral via capsule <2e-16
## CAS.Number135410207:Exposure.TypeSpray <2e-16
## CAS.Number138261413:Exposure.TypeSpray <2e-16
## CAS.Number150824478:Exposure.TypeSpray NA
## CAS.Number153719234:Exposure.TypeSpray NA
## CAS.Number165252700:Exposure.TypeSpray NA
## CAS.Number210880925:Exposure.TypeSpray <2e-16
## CAS.Number135410207:Exposure.TypeTopical, general NA
## CAS.Number138261413:Exposure.TypeTopical, general <2e-16
## CAS.Number150824478:Exposure.TypeTopical, general NA
## CAS.Number153719234:Exposure.TypeTopical, general <2e-16
## CAS.Number165252700:Exposure.TypeTopical, general NA
## CAS.Number210880925:Exposure.TypeTopical, general NA
##
## (Intercept) ***
## CAS.Number135410207 ***
## CAS.Number138261413 ***
## CAS.Number150824478 ***
## CAS.Number153719234 ***
## CAS.Number165252700 ***
## CAS.Number210880925 ***
## Exposure.TypeDermal ***
## Exposure.TypeDiet, unspecified ***
## Exposure.TypeDirect application ***
## Exposure.TypeDrinking water ***
## Exposure.TypeDropwise ***
## Exposure.TypeEnvironmental, unspecified ***
## Exposure.TypeFood ***
## Exposure.TypeGround granular ***
## Exposure.TypeHand spray ***
## Exposure.TypeMultiple routes between application groups ***
## Exposure.TypeOral via capsule ***
## Exposure.TypeSpray ***
## Exposure.TypeTopical, general ***
## CAS.Number135410207:Exposure.TypeDermal ***
## CAS.Number138261413:Exposure.TypeDermal ***
## CAS.Number150824478:Exposure.TypeDermal ***
## CAS.Number153719234:Exposure.TypeDermal ***
## CAS.Number165252700:Exposure.TypeDermal ***
## CAS.Number210880925:Exposure.TypeDermal ***
## CAS.Number135410207:Exposure.TypeDiet, unspecified ***
## CAS.Number138261413:Exposure.TypeDiet, unspecified ***
## CAS.Number150824478:Exposure.TypeDiet, unspecified ***
## CAS.Number153719234:Exposure.TypeDiet, unspecified ***

```



```

## CAS.Number165252700:Exposure.TypeDiet, unspecified
## CAS.Number210880925:Exposure.TypeDiet, unspecified
## CAS.Number135410207:Exposure.TypeDirect application
## CAS.Number138261413:Exposure.TypeDirect application
## CAS.Number150824478:Exposure.TypeDirect application
## CAS.Number153719234:Exposure.TypeDirect application
## CAS.Number165252700:Exposure.TypeDirect application
## CAS.Number210880925:Exposure.TypeDirect application
## CAS.Number135410207:Exposure.TypeDrinking water
## CAS.Number138261413:Exposure.TypeDrinking water
## CAS.Number150824478:Exposure.TypeDrinking water
## CAS.Number153719234:Exposure.TypeDrinking water
## CAS.Number165252700:Exposure.TypeDrinking water
## CAS.Number210880925:Exposure.TypeDrinking water
## CAS.Number135410207:Exposure.TypeDropwise
## CAS.Number138261413:Exposure.TypeDropwise
## CAS.Number150824478:Exposure.TypeDropwise
## CAS.Number153719234:Exposure.TypeDropwise
## CAS.Number165252700:Exposure.TypeDropwise
## CAS.Number210880925:Exposure.TypeDropwise
## CAS.Number135410207:Exposure.TypeEnvironmental, unspecified      ***
## CAS.Number138261413:Exposure.TypeEnvironmental, unspecified    ***
## CAS.Number150824478:Exposure.TypeEnvironmental, unspecified
## CAS.Number153719234:Exposure.TypeEnvironmental, unspecified      ***
## CAS.Number165252700:Exposure.TypeEnvironmental, unspecified      ***
## CAS.Number210880925:Exposure.TypeEnvironmental, unspecified      ***
## CAS.Number135410207:Exposure.TypeFood                           ***
## CAS.Number138261413:Exposure.TypeFood                           ***
## CAS.Number150824478:Exposure.TypeFood
## CAS.Number153719234:Exposure.TypeFood                           ***
## CAS.Number165252700:Exposure.TypeFood                           ***
## CAS.Number210880925:Exposure.TypeFood                           ***
## CAS.Number135410207:Exposure.TypeGround granular
## CAS.Number138261413:Exposure.TypeGround granular
## CAS.Number150824478:Exposure.TypeGround granular
## CAS.Number153719234:Exposure.TypeGround granular
## CAS.Number165252700:Exposure.TypeGround granular
## CAS.Number210880925:Exposure.TypeGround granular
## CAS.Number135410207:Exposure.TypeHand spray
## CAS.Number138261413:Exposure.TypeHand spray
## CAS.Number150824478:Exposure.TypeHand spray
## CAS.Number153719234:Exposure.TypeHand spray
## CAS.Number165252700:Exposure.TypeHand spray
## CAS.Number210880925:Exposure.TypeHand spray
## CAS.Number135410207:Exposure.TypeMultiple routes between application groups

```

```

## CAS.Number138261413:Exposure.TypeMultiple routes between application groups
## CAS.Number150824478:Exposure.TypeMultiple routes between application groups
## CAS.Number153719234:Exposure.TypeMultiple routes between application groups
## CAS.Number165252700:Exposure.TypeMultiple routes between application groups
## CAS.Number210880925:Exposure.TypeMultiple routes between application groups
## CAS.Number135410207:Exposure.TypeOral via capsule ***
## CAS.Number138261413:Exposure.TypeOral via capsule ***
## CAS.Number150824478:Exposure.TypeOral via capsule
## CAS.Number153719234:Exposure.TypeOral via capsule ***
## CAS.Number165252700:Exposure.TypeOral via capsule ***
## CAS.Number210880925:Exposure.TypeOral via capsule ***
## CAS.Number135410207:Exposure.TypeSpray ***
## CAS.Number138261413:Exposure.TypeSpray ***
## CAS.Number150824478:Exposure.TypeSpray
## CAS.Number153719234:Exposure.TypeSpray
## CAS.Number165252700:Exposure.TypeSpray
## CAS.Number210880925:Exposure.TypeSpray ***
## CAS.Number135410207:Exposure.TypeTopical, general
## CAS.Number138261413:Exposure.TypeTopical, general ***
## CAS.Number150824478:Exposure.TypeTopical, general
## CAS.Number153719234:Exposure.TypeTopical, general ***
## CAS.Number165252700:Exposure.TypeTopical, general
## CAS.Number210880925:Exposure.TypeTopical, general
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 1757.6  on 1406  degrees of freedom
## Residual deviance: 33376.4  on 1361  degrees of freedom
## AIC: 33468
##
## Number of Fisher Scoring iterations: 25

pR2(logit) fitting null model for pseudo-r2 llh llhNull G2 McFadden r2ML r2CU
-810.68616225 -878.77992574 136.18752697 0.07748671 0.09225597 0.12934540
kable(pR2(logit)) fitting null model for pseudo-r2

```

	x
llh	-810.6861623
llhNull	-878.7799257
G2	136.1875270
McFadden	0.0774867
r2ML	0.0922560

	x
r2CU	0.1293454

kable(logit3) Error in as.data.frame.default(x) : cannot coerce class ‘c(“glm”, “lm”)’ to a data.frame kable(summary(logit3)) Error in as.data.frame.default(x) : cannot coerce class ‘“summary.glm”’ to a data.frame kable(glm(Mortality ~ CAS.Number, data = BeeMortalityExposureType, family = “binomial”)) Error in as.data.frame.default(x) : cannot coerce class ‘c(“glm”, “lm”)’ to a data.frame summary(logit3)

Call: glm(formula = Mortality ~ CAS.Number, family = “binomial”, data = BeeMortalityExposureType)

Deviance Residuals: Min 1Q Median 3Q Max
-1.5453 -0.7585 -0.7585 1.2286 1.7080

Non-Bee Exposure Type	Pr(>
Dipped or soaked	0.003227
Direct application	3.42e-05
Drinking water	0.021404
Environmental, unspecified	0.000278
Foliar spray	3.14e-11
Ground spray	1.15e-06
Hand spray	3.41e-09
Spray	2.16e-08
Topical, general	0.018538

Exposure Effect on Bees	Pr(>
Topical, general	0.009 **

Chemical Effect on Bees	Pr(>
135410207	9.10e-06 ***
138261413	6.39e-07 ***
153719234	0.017062 *
165252700	0.003599 **
210880925	0.000189 ***

Chemical Effect on Non-Bees	Pr(>
Chemical	None

Detail	Description
Data Source	EPA ECOTOX Knowledgebase
Retrieved From	https://cfpub.epa.gov/ecotox/help.cfm
Variables Used	Chemical Name, Species Common Name, Organism Lifestage, Organism Age, Exposure Type, Effect, Effect Measurement
Date Range	1982-2019

3 Exploratory Analysis

Table 7: Species List

	x
Honey Bee	667
Parasitic Wasp	285
Buff Tailed Bumblebee	183
Carniolan Honey Bee	152
Bumble Bee	140
Italian Honeybee	113
Japanese Beetle	94
Asian Lady Beetle	76
Euonymus Scale	75
Wireworm	69
European Dark Bee	66
Minute Pirate Bug	62
Asian Citrus Psyllid	60
Parastic Wasp	58
Colorado Potato Beetle	57
Parasitoid Wasp	51
Erythrina Gall Wasp	49
Beetle Order	47
Snout Beetle Family, Weevil	47
Sevenspotted Lady Beetle	46
True Bug Order	45
Buff-tailed Bumblebee	39
Aphid Family	38
Cabbage Looper	38
Sweetpotato Whitefly	37
Braconid Wasp	33
Cotton Aphid	33
Predatory Mite	33
Ladybird Beetle Family	30
Parasitoid	30
Scarab Beetle	29
Spring Tiphia	29
Thrip Order	29
Ground Beetle Family	27
Rove Beetle Family	27
Tobacco Aphid	27
Chalcid Wasp	25
Convergent Lady Beetle	25
Stingless Bee	25

	x
Spider/Mite Class	24
Tobacco Flea Beetle	24
Citrus Leafminer	23
Ladybird Beetle	23
Mason Bee	22
Mosquito	22
Argentine Ant	21
Beetle	21
Flatheaded Appletree Borer	20
Horned Oak Gall Wasp	20
Leaf Beetle Family	20
Potato Leafhopper	20
Tooth-necked Fungus Beetle	20
Codling Moth	19
Black-spotted Lady Beetle	18
Calico Scale	18
Fairyfly Parasitoid	18
Lady Beetle	18
Minute Parasitic Wasps	18
Mirid Bug	18
Mulberry Pyralid	18
Silkworm	18
Vedalia Beetle	18
Araneoid Spider Order	17
Bee Order	17
Egg Parasitoid	17
Insect Class	17
Moth And Butterfly Order	17
Oystershell Scale Parasitoid	17
Hemlock Woolly Adelgid Lady Beetle	16
Hemlock Wooly Adelgid	16
Mite	16
Onion Thrip	16
Western Flower Thrips	15
Corn Earworm	14
Green Peach Aphid	14
House Fly	14
Ox Beetle	14
Red Scale Parasite	14
Spined Soldier Bug	14
Armoured Scale Family	13
Diamondback Moth	13
Eulophid Wasp	13

	x
Monarch Butterfly	13
Predatory Bug	13
Yellow Fever Mosquito	13
Braconid Parasitoid	12
Common Thrip	12
Eastern Subterranean Termite	12
Jassid	12
Mite Order	12
Pea Aphid	12
Pond Wolf Spider	12
Spotless Ladybird Beetle	11
Glasshouse Potato Wasp	10
Lacewing	10
Southern House Mosquito	10
Two Spotted Lady Beetle	10
Ant Family	9
Apple Maggot	9
(Other)	670

##	Choice
##	10
##	Dermal
##	13
##	Diet, unspecified
##	11
##	Dipped or soaked
##	0
##	Direct application
##	0
##	Drinking water
##	1
##	Dropwise
##	1
##	Environmental, unspecified
##	56
##	Filmcoating
##	0
##	Foliar spray
##	0
##	Food
##	253
##	Ground granular

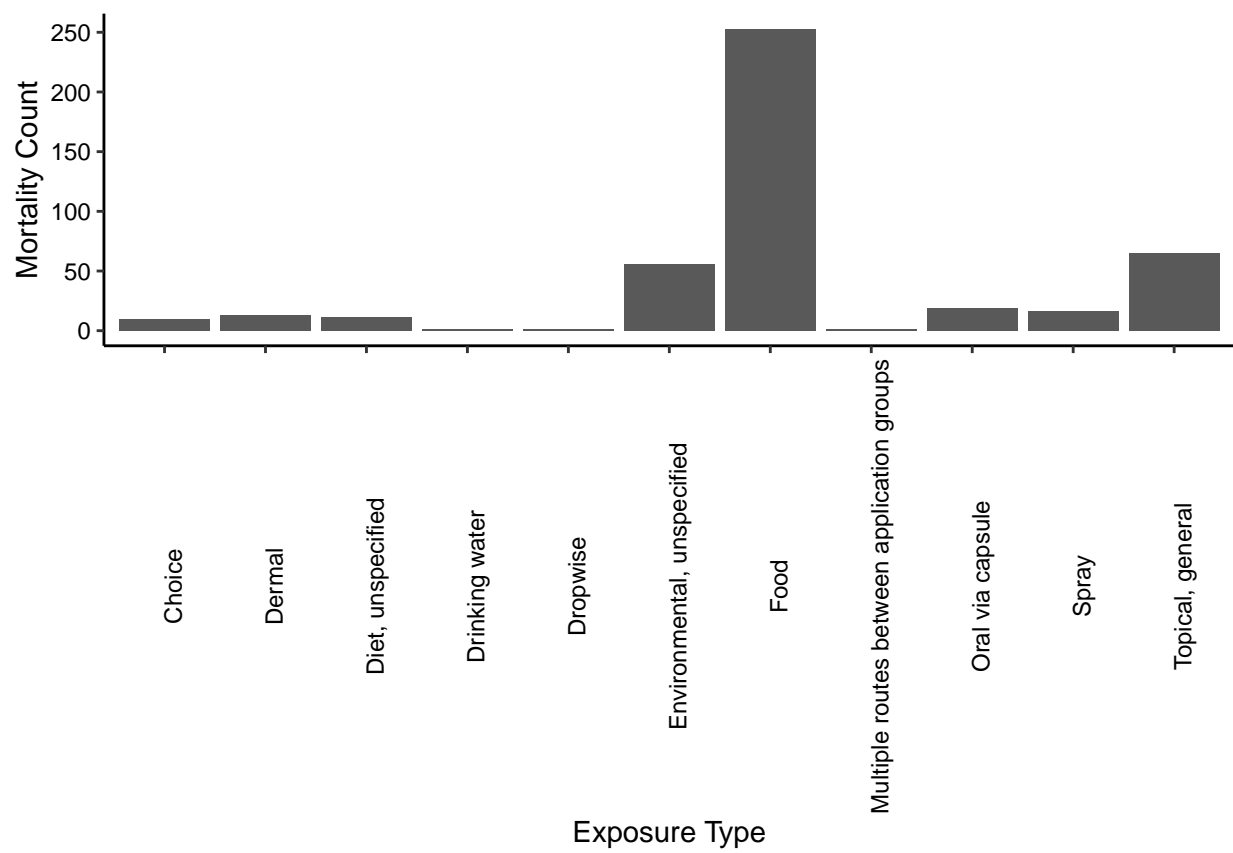


Figure 1: Bee Mortality by Exposure Type

##		0
##	Ground spray	
##		0
##	Growth medium	
##		0
##	Hand spray	
##		0
##	Immersion	
##		0
##	Misted	
##		0
##	Multiple routes between application groups	
##		1
##	Multiple routes within environmental exposures	
##		0
##	Oral via capsule	
##		19
##	Present in soil	
##		0
##	Spray	
##		16
##	Topical, general	
##		65
##	Watered	
##		0
##	Choice	
##		27
##	Dermal	
##		66
##	Diet, unspecified	
##		22
##	Dipped or soaked	
##		0
##	Direct application	
##		2
##	Drinking water	
##		1
##	Dropwise	
##		1
##	Environmental, unspecified	
##		140
##	Filmcoating	
##		0
##	Foliar spray	

##	0
##	Food
##	977
##	Ground granular
##	5
##	Ground spray
##	0
##	Growth medium
##	0
##	Hand spray
##	4
##	Immersion
##	0
##	Misted
##	0
##	Multiple routes between application groups
##	7
##	Multiple routes within environmental exposures
##	0
##	Oral via capsule
##	19
##	Present in soil
##	0
##	Spray
##	37
##	Topical, general
##	99
##	Watered
##	0
##	Choice
##	0
##	Dermal
##	23
##	Diet, unspecified
##	4
##	Dipped or soaked
##	49
##	Direct application
##	35
##	Drinking water
##	12
##	Dropwise
##	0
##	Environmental, unspecified

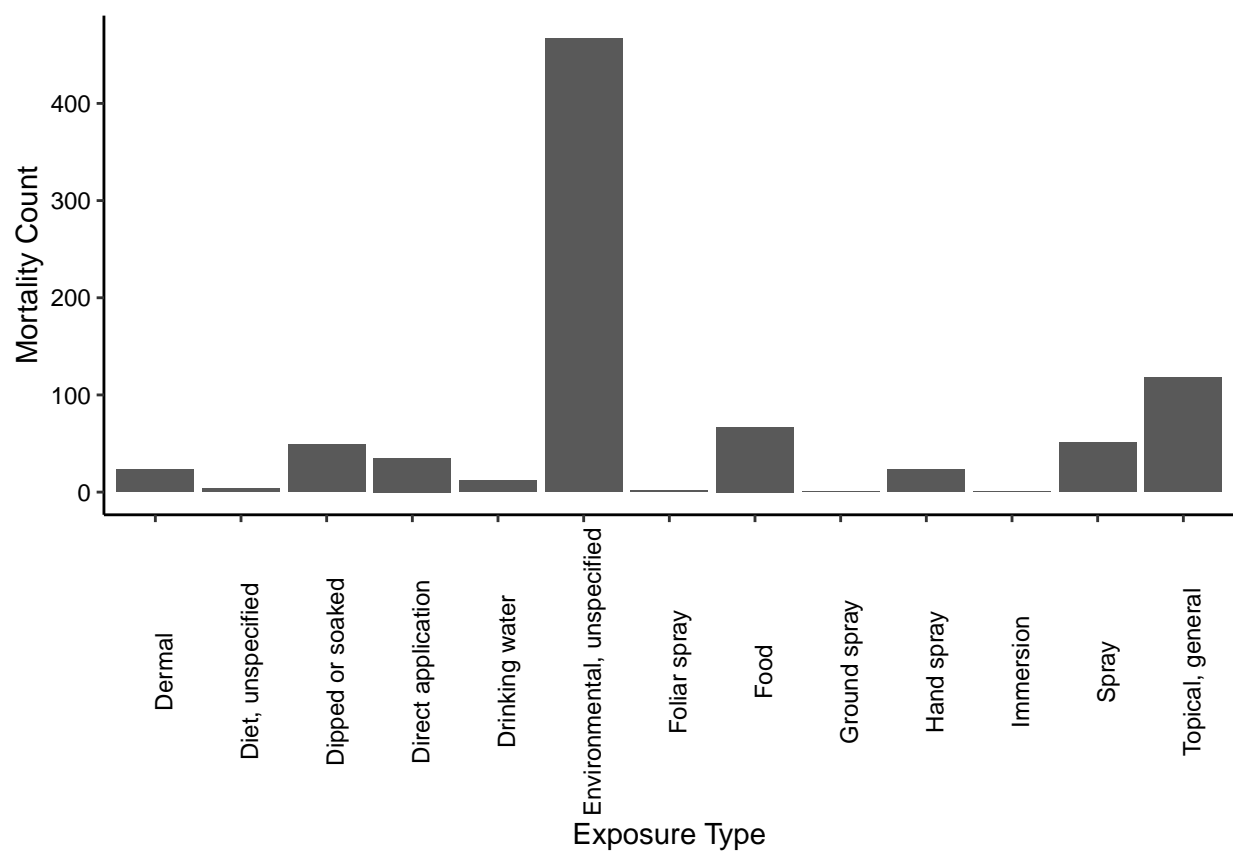


Figure 2: Non-bee Mortality by Exposure Type

##	467
##	Filmcoating
##	0
##	Foliar spray
##	2
##	Food
##	67
##	Ground granular
##	0
##	Ground spray
##	1
##	Growth medium
##	0
##	Hand spray
##	23
##	Immersion
##	1
##	Misted
##	0
##	Multiple routes between application groups
##	0
##	Multiple routes within environmental exposures
##	0
##	Oral via capsule
##	0
##	Present in soil
##	0
##	Spray
##	51
##	Topical, general
##	118
##	Watered
##	0
##	Choice
##	0
##	Dermal
##	30
##	Diet, unspecified
##	6
##	Dipped or soaked
##	109
##	Direct application
##	112
##	Drinking water

##	26
##	Dropwise
##	0
##	Environmental, unspecified
##	1160
##	Filmcoating
##	1
##	Foliar spray
##	155
##	Food
##	100
##	Ground granular
##	210
##	Ground spray
##	64
##	Growth medium
##	0
##	Hand spray
##	148
##	Immersion
##	1
##	Misted
##	8
##	Multiple routes between application groups
##	0
##	Multiple routes within environmental exposures
##	2
##	Oral via capsule
##	0
##	Present in soil
##	3
##	Spray
##	254
##	Topical, general
##	128
##	Watered
##	12

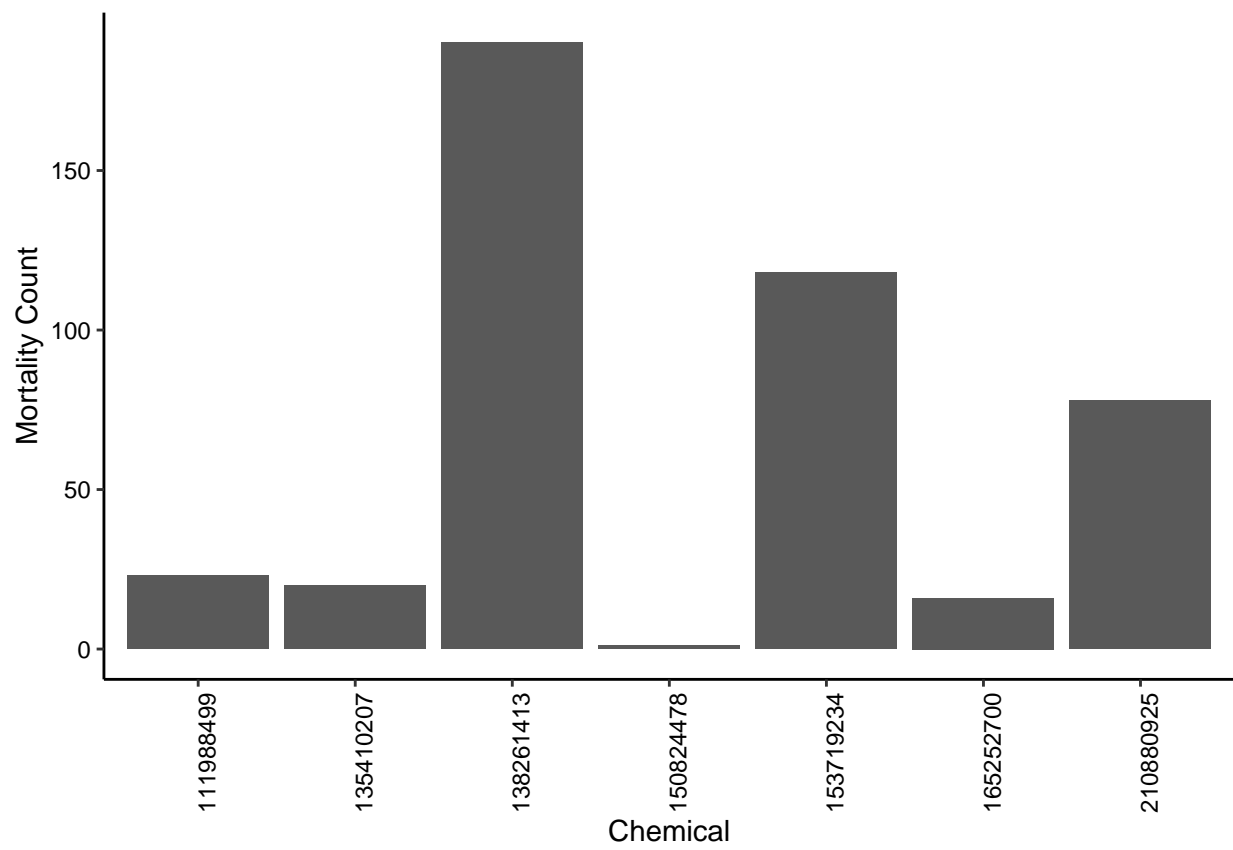


Figure 3: Bee Mortality by Chemical

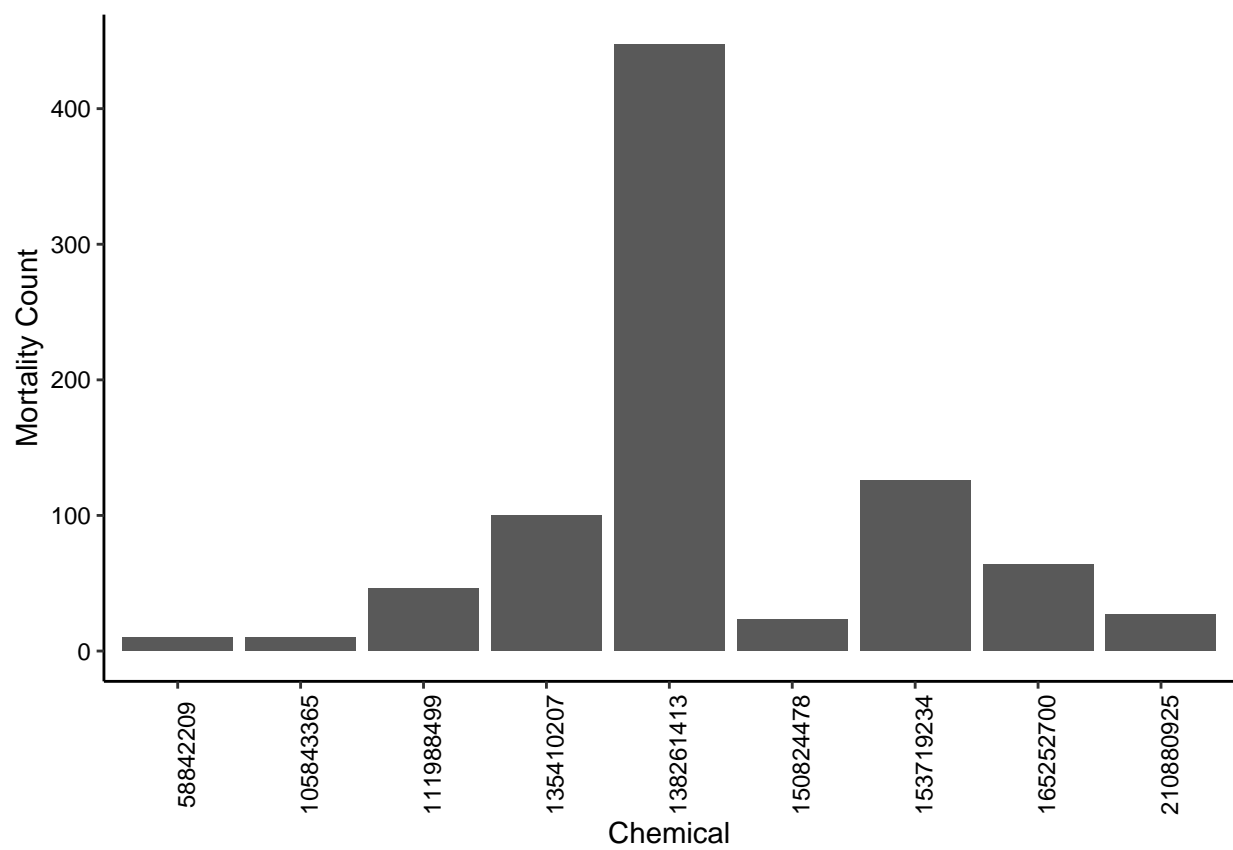


Figure 4: Non-bee Mortality by Chemical

4 Analysis

4.1 Question 1: Is there an exposure type that has less impact on bees than non-bee insects?

x

CAS.Number
Chemical.Name
Species.Common.Name
Organism.Lifestage
Organism.Age
Exposure.Type
Effect
Effect.Measurement

4.2 Question 2: Are there chemicals that have a high mortality rate for non-bee insects and low rate for bees?

5 Summary and Conclusions

6 References

<add references here if relevant, otherwise delete this section>