Porter et al, 1999

Guidelines/Criteria	
Reference:	Porter WP, Jaeger JW, Carlson IH. 1999. Endocrine, immune, and behavioral effects of aldicarb (carbamate), atrazine (triazine) and nitrate (fertilizer) mixtures at groundwater concentrations. Toxicol Ind Health 15:133-150.
In vivo **Study Type**	Seven studies which are relevant, (two others were not comparable and were not considered)
Route of Administration	Drinking water
Species & age of animals	Male Wisconsin deer mice (Peromyscus maniculatus) and male Swiss Webster ND4 mice
Study Duration	22-103 days depending on study
Type of Mixture	
Binary	Yes, all 3 combinations
>2 components	Yes, all three together
Similar acting or dissimilar	Dissimilar
What Mode of Action was investigated?	Nothing specific
Parameters/End points Measured	
Target organs/Critical effects	Free thyroxine index, plaque-forming cell assay using sheep red blood cells, aggression against and intruder or exploratory holepoke tests, body weight and spleen weight.
Pharmacological changes or adverse effects	No consistent effects seen, and probably no real effects at all
Individual Components	
Characterisation of individual compounds	
Name, exact chemical name, CAS no.	Aldicarb, atrazine and nitrate
Were dose responses established for individual components?	No, only tested at a dose of "the same order of magnitude as current maximum contaminant levels". Tested at 10ppb for aldicarb and atrazine (MCL was 3ppb), 28ppb for nitrate (MCL was 10ppb)
Were no effect levels established?	Yes
Were doses below the NO(A)ELs investigated?	No
Mixtures Investigated	
Number of dose levels	One
How does the mixture make-up compare to individual components? (e.g. low dose) equivalents used?)	Doses of the three components were chosen to be of "the same order of magnitude as current maximum contaminant levels".
No. of technical replicates per exposure condition (*in vitro*)	
No. of animals per dose group (*in vivo*)	6
Observations/Findings	There were no consistent effects across experiments. The authors suggested that mixtures including nitrate tended to have effects, and that there was a seasonality to effects in the plaque-forming assay.
Overall opinion (e.g. sufficient numbers of groups investigated, group sizes adequate, observations reproducible, low dose levels used investigated)	For Swiss Webster mice, there were 4 studies, and no statistically significant effect seen in any study for single chemicals or mixtures was ever repeated in the other studies. For deer mice, there were 3 studies. The only statistically significant effect which was ever repeated, was the effect of aldicarb+nitrate and atrazine+nitrate of the plaque-forming cell assay. This was significant in 2 out of 3 studies, but in these same studies the single components and the 3-way mixture did not produce an effect. For Swiss Webster mice there were 2 additional studies, using 100/1000 ppb of atrazine with other treatments the same as in the rest of the studies. There were some statistically significant effects, but without a pattern. This is a large program of experiments, amounting to effectively three similar studies on each mouse species. Individual studies are not fully reported. Poor standard of reporting.