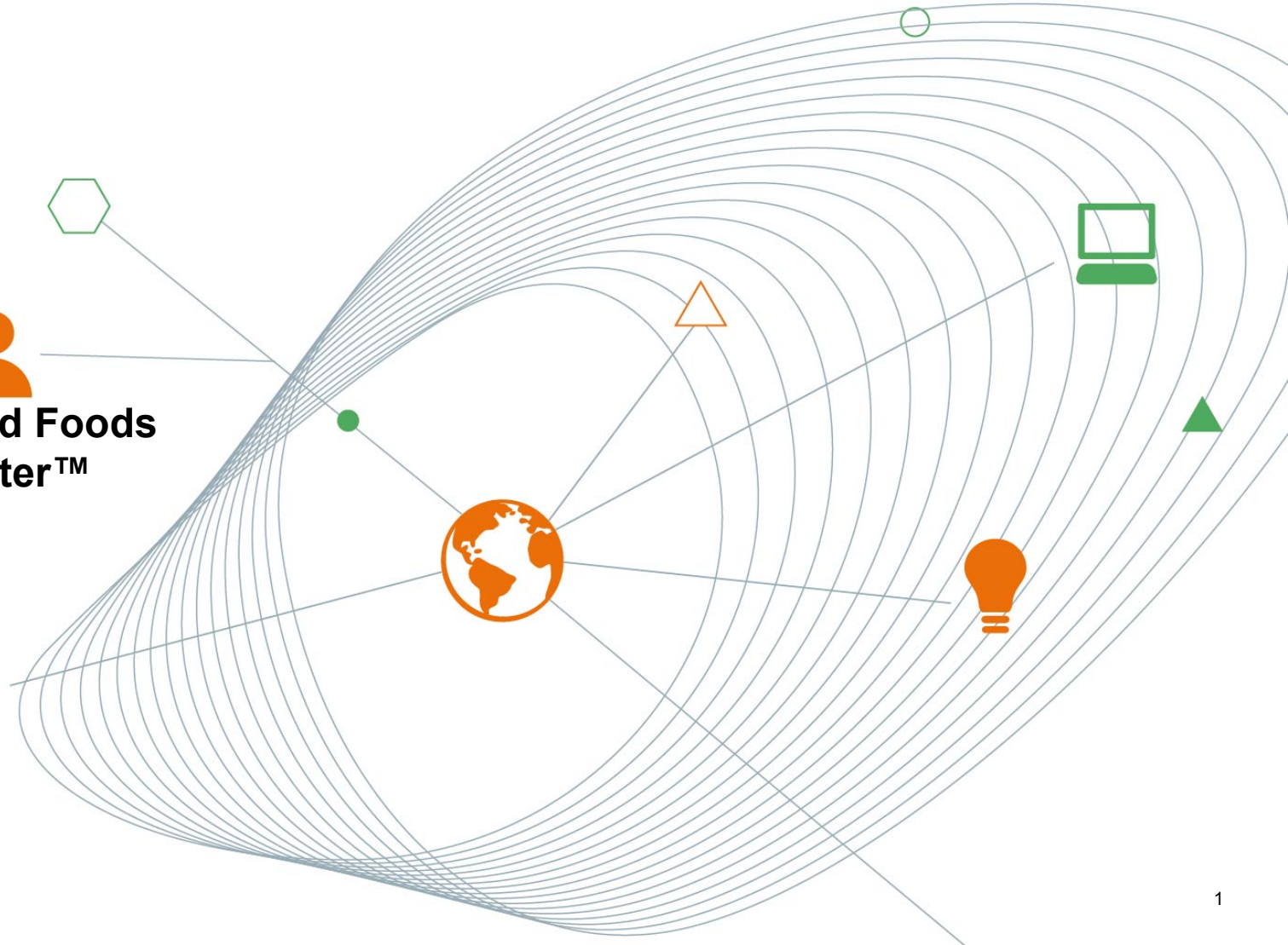
Results emerge when local knowledge intersects with global expertise

coffey
A TETRA TECH COMPANY



Human Intake of PFAS from Locally Sourced Foods in an Environment Impacted by 3M Lightwater™

Sarah Richards and Karen Teague,
Coffey, Melbourne, Australia
Andrew Mitchell, RPS, Sydney, Australia
Marcus Bowersox, Tetra Tech, Baltimore, USA

A presentation to Battelle Baltimore
17 April 2019

PFAS Investigation & Management Program

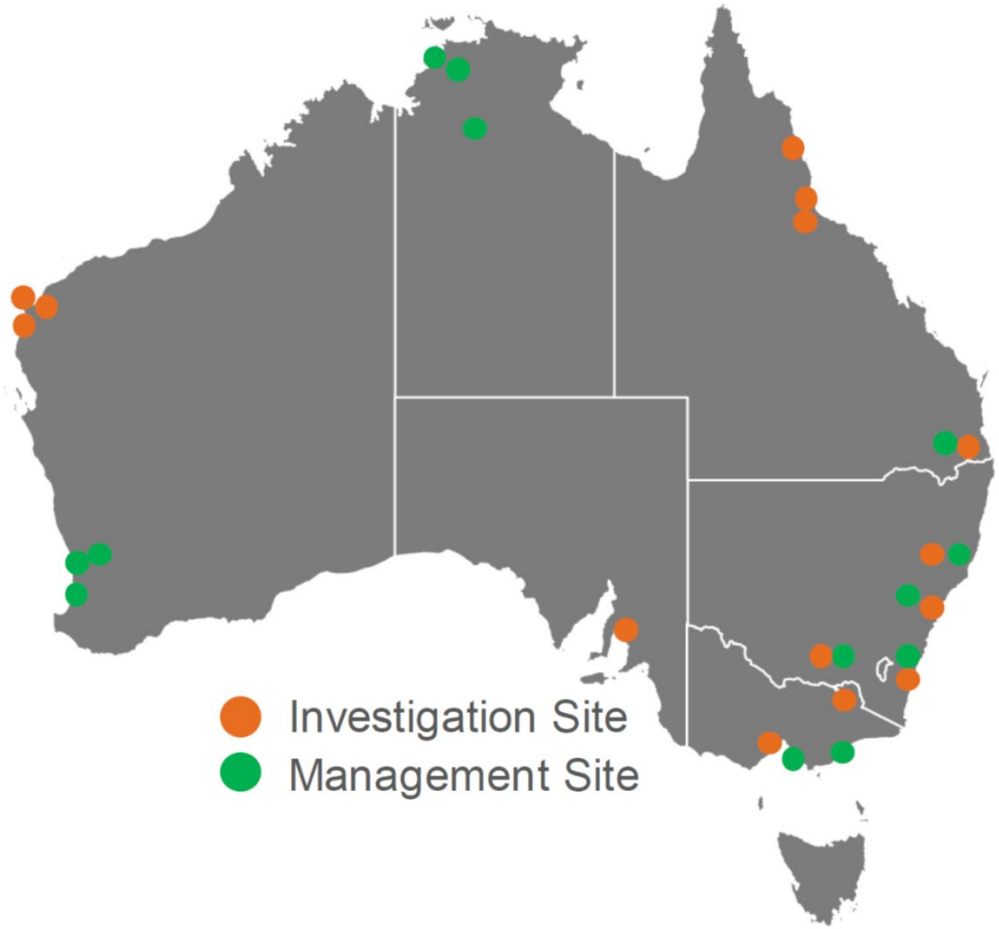
Australian Government
Department of Defence
Estate and Infrastructure Group

coffey
A TETRA TECH COMPANY

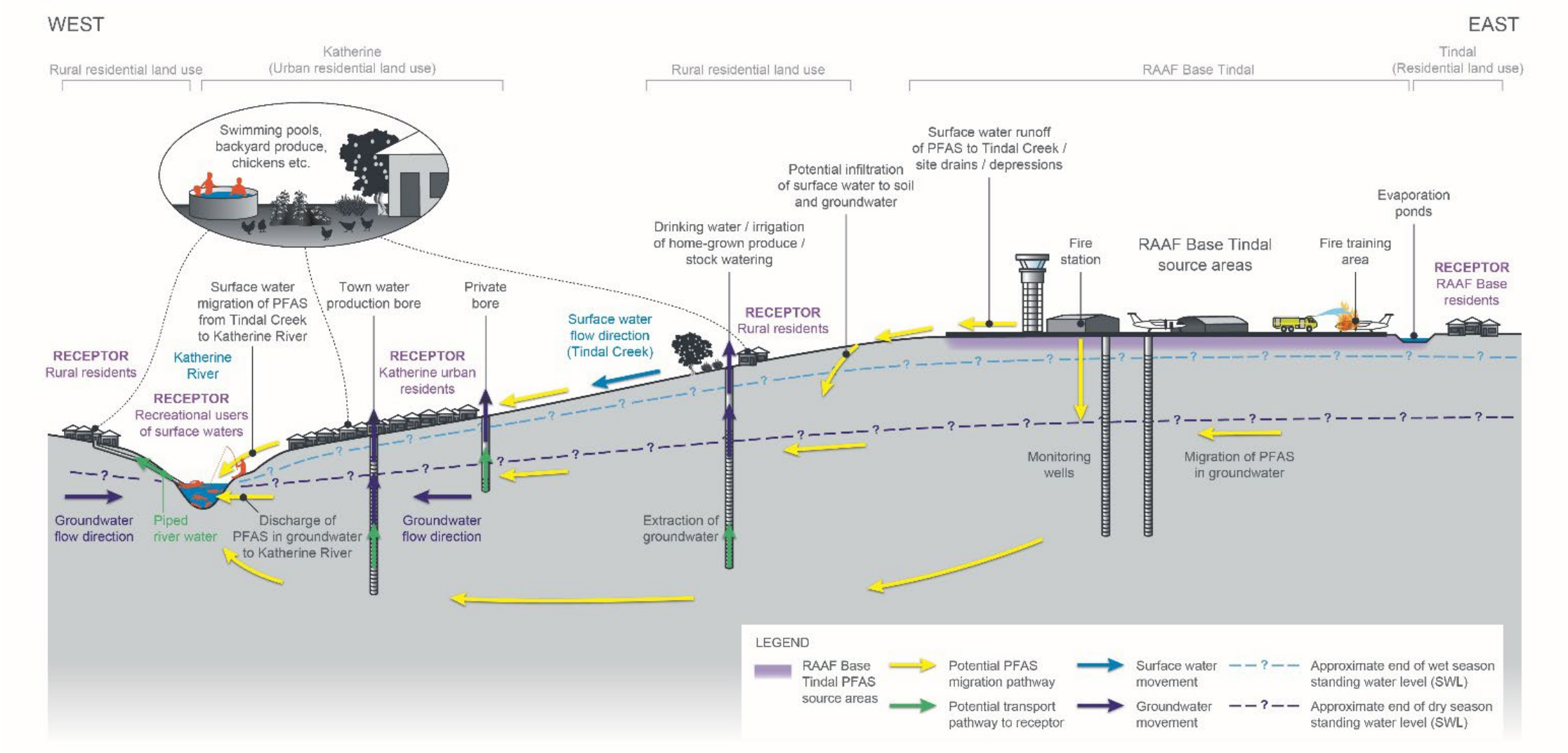
Defence is undertaking a national program to review, investigate and implement a comprehensive approach to manage the impacts of per- and poly-fluoroalkyl substances (PFAS) on, and in the vicinity of, some of its bases around Australia.

Defence is undertaking environmental investigations in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM). There are three main steps to the investigation process:

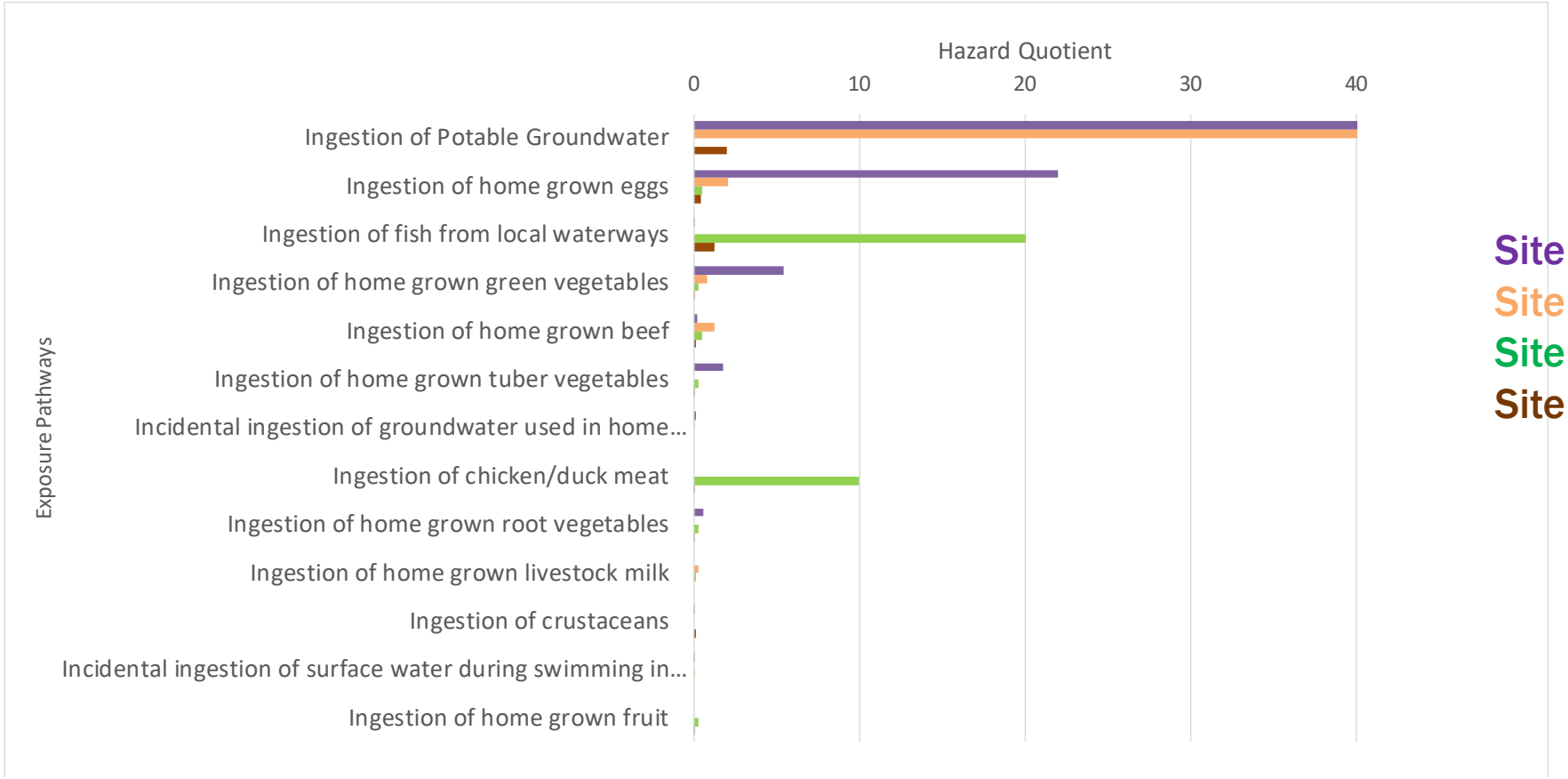
- Preliminary Site Investigation (PSI),
- Detailed Site Investigation (DSI) and
- Human Health and Ecological Risk Assessment, where required.



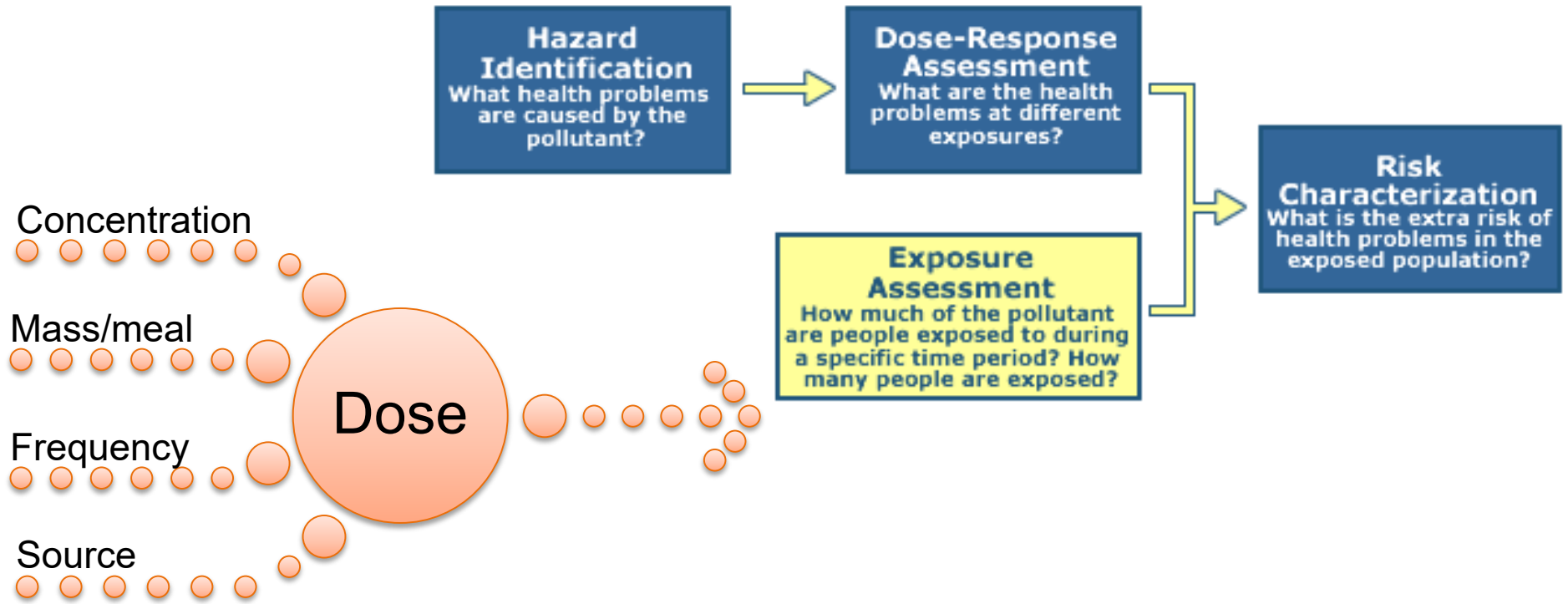
Health risk assessment approach



Risk drivers / Key exposure pathways

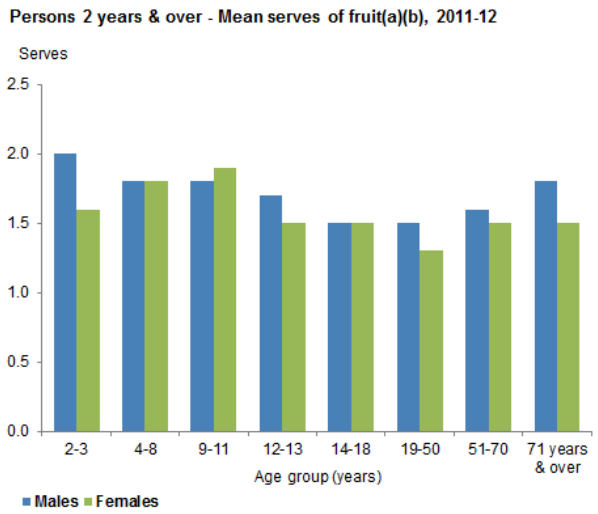


The 4 Step Risk Assessment Process



Population wide information

- Data available for serve size, frequency of consumption and home-grown
- Defensible “typical” scenario
- Cultural, climatic and land-use impacts the relevance



1 serve = 150 g
(a) Based on Day 1. See Glossary for definition.
(b) From non-discretionary sources.
Source: National Nutrition and Physical Activity Survey, 2011-12.

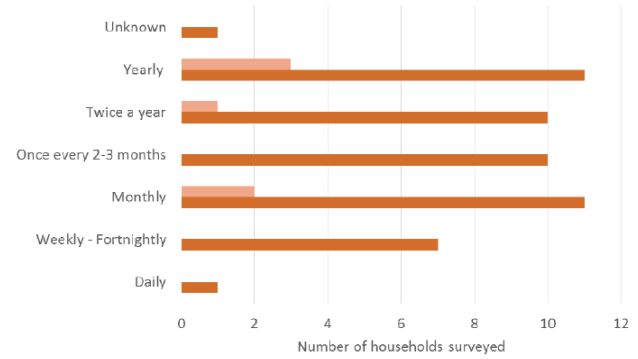
Table 4.2.8: Suggested values for drinking water intake (L/day)

Group			(L/day) [c]
Adult (M & F combined, pregnant women)	Lifetime average daily intake		2
	Short/medium term exposure[a]		
		Mean	1.2
		90th percentile	2.3
		95th percentile	2.8
	Temperate climate	Moderate work	5
	Tropical climate	Moderate work	10
Lactating women		Mean	1.8
		90th percentile	3.5
		95th percentile	4.2
Child[b] (2 year old)	Mean		0.4
	90th percentile		0.7
	95th percentile		0.9

Site specific surveys

- Surveys distributed by email, hand, post and available on-line
- Questions covering water source, use of water on property, use of surrounding land, use of local waterways.
- Some groups approached to complete survey over the phone or face to face.
- Results applied as a guide to pathways and frequency.

Stakeholder	Events	Stakeholders	
		distinct	total
Inside IA	133	133	133
Town water	118	118	118
Tank water	28	28	28
Vegetable garden	21	21	21
Fruit	18	18	18
Flooding/ drains	18	18	18
Number: 1 - 3	14	14	14
In ground	13	13	13
Concrete	11	11	11
Plastic	10	10	10
Other	113	113	113
Total Event search	**133**	**133**	**133**



Methodology to establish exposure concentrations

Manual methods of targeted sample collection

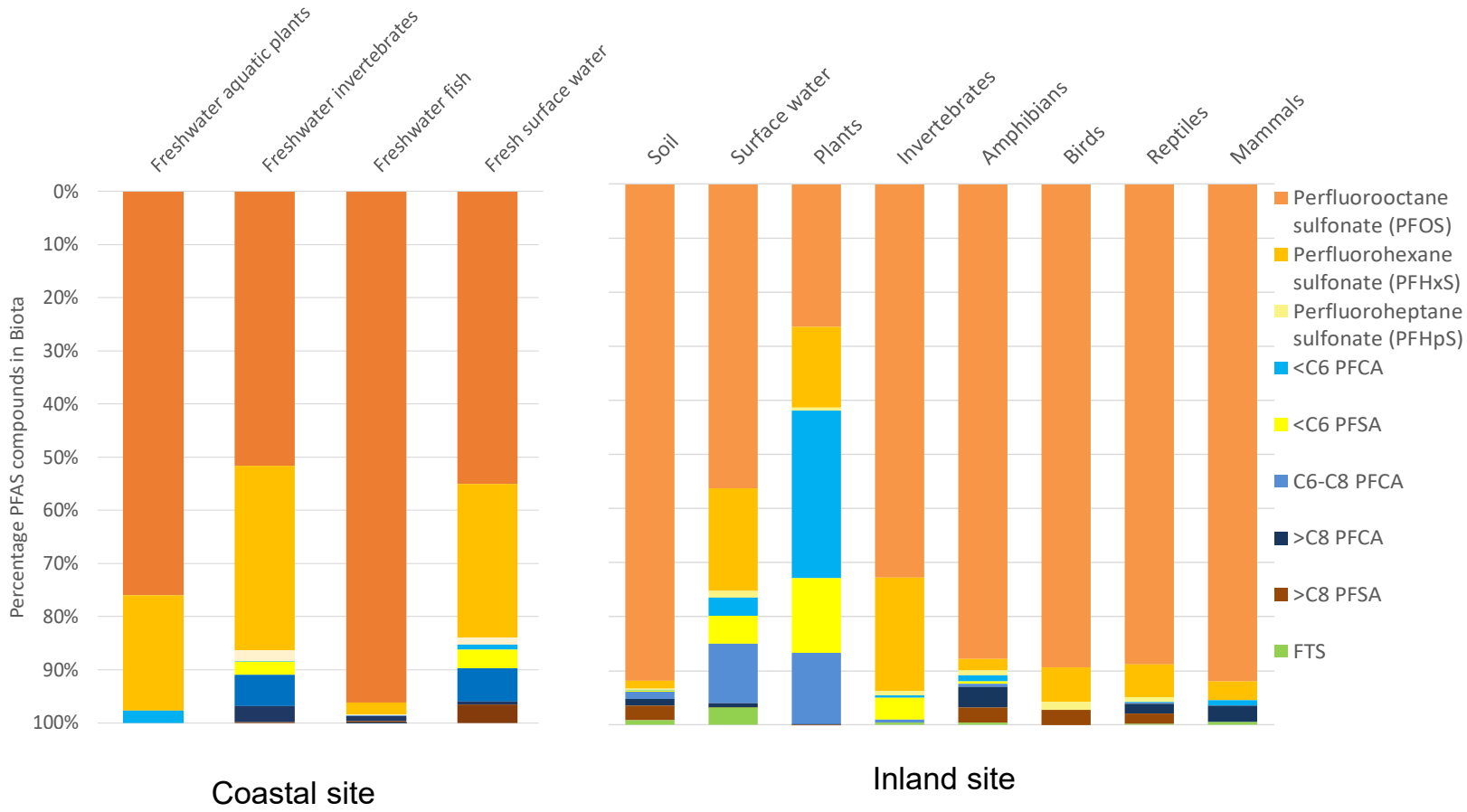
Terrestrial	Aquatic
Soils	Sediment
Bore water	Surface water
Vegetables and fruit	Plants
Eggs	Molluscs
Livestock serum	Crustaceans
Birds (opportunistically)	Fish
Mammals	Reptiles

Analysis of

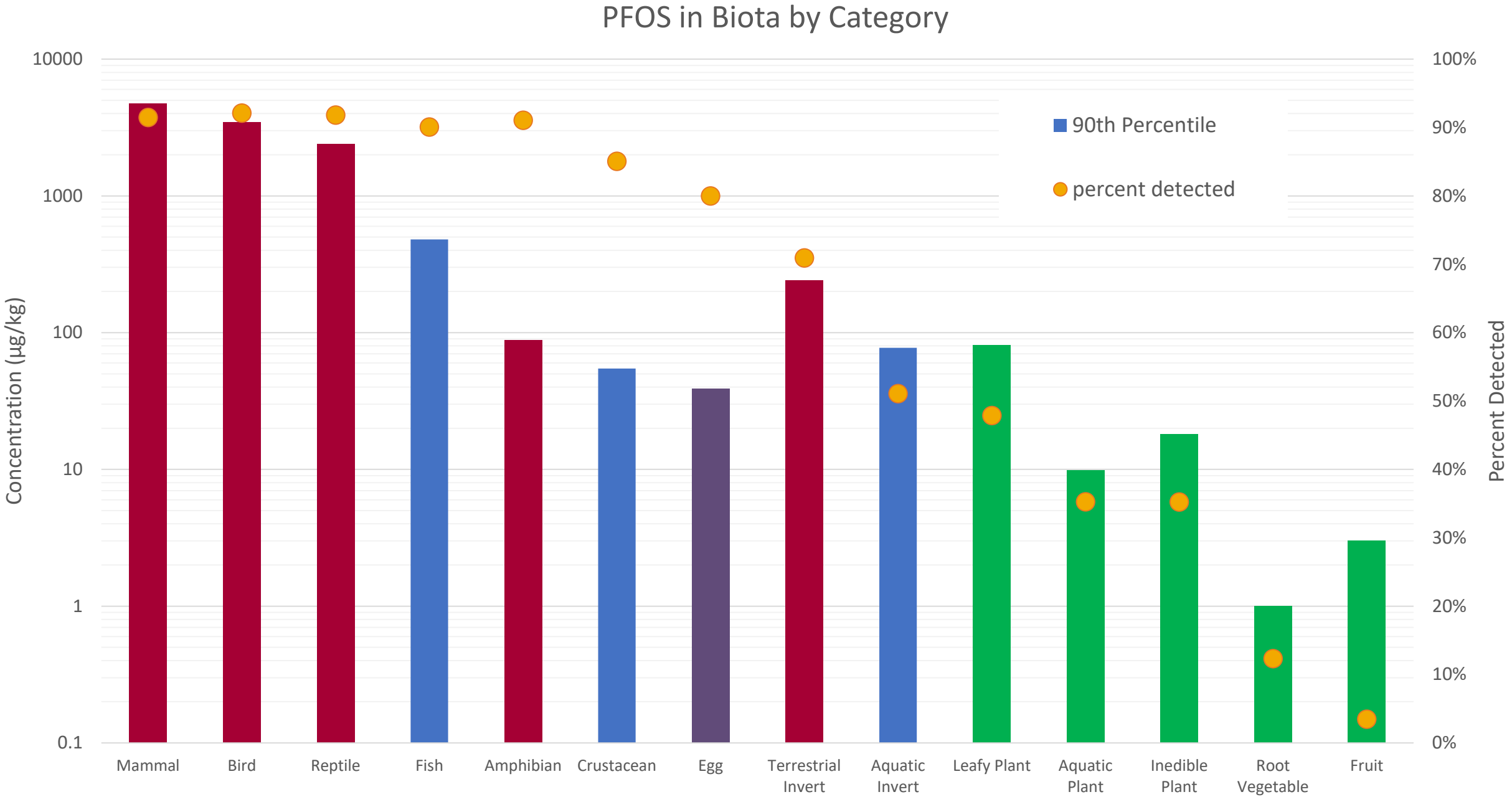
- 28 compound suite
- Edible portions

Composition

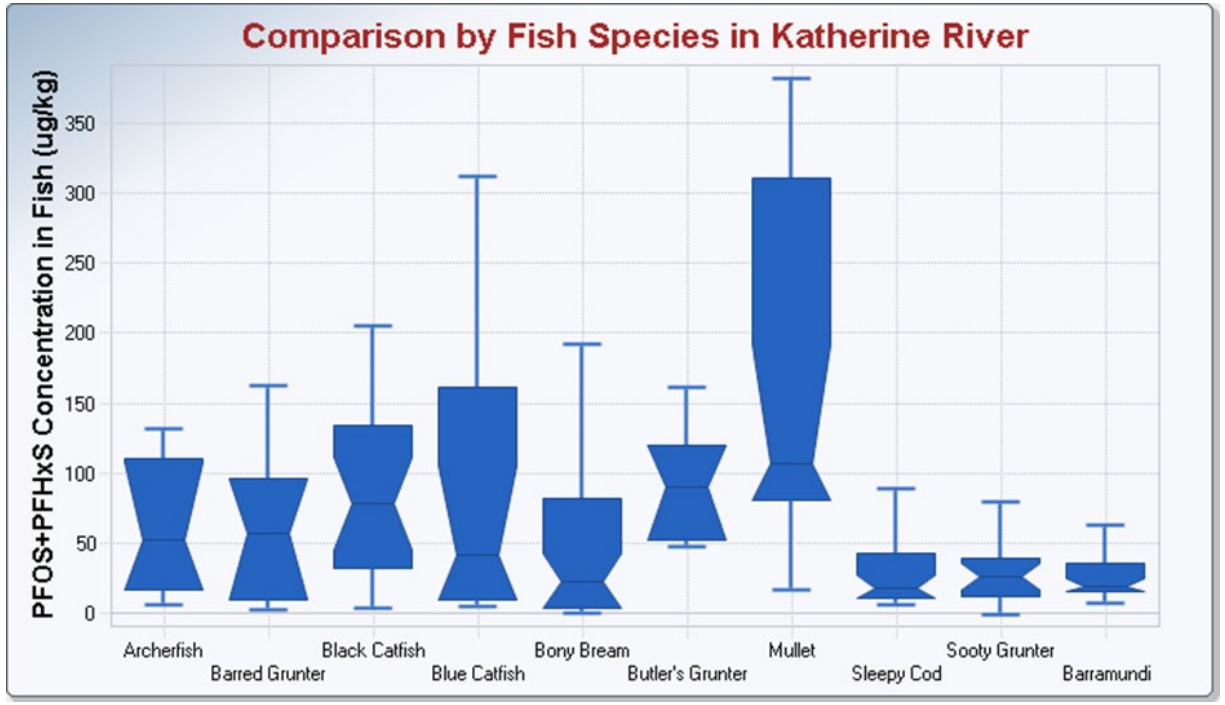
- Plants and invertebrates reflect soil and water
- Other animals reflected bioaccumulative pattern
- PFOS and PFHxS dominant
- PFBA and PFBS in plants
- Multiple compounds in invertebrates
- Almost exclusively PFOS in fish

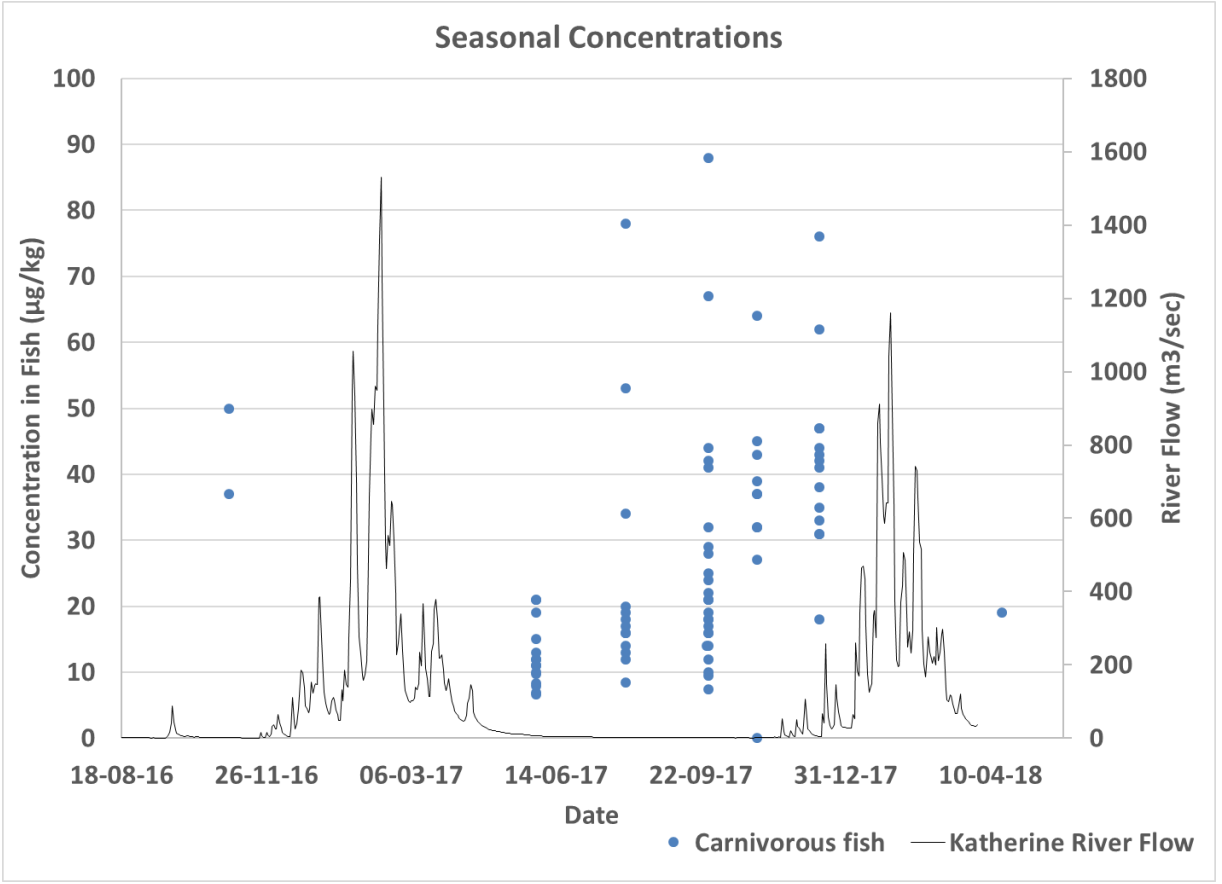


PFOS + PFHxS accounted for most of the PFAS detected

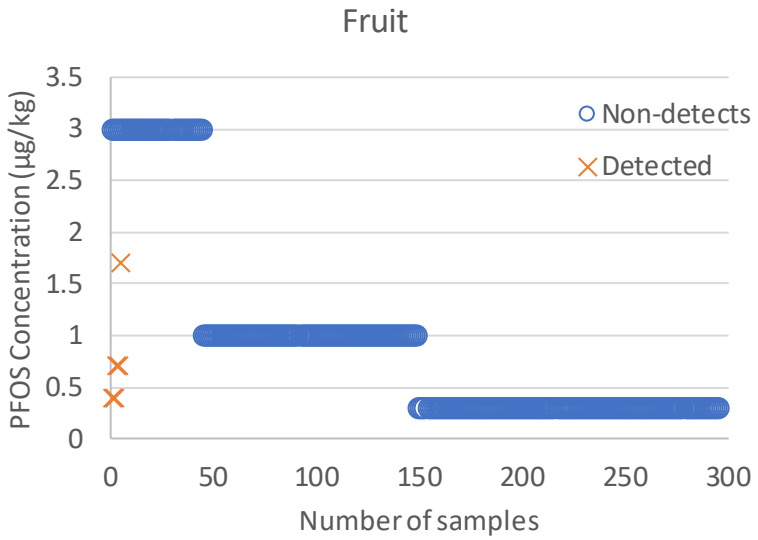

PFOS in Biota by Category
10000
1000
100
10
1
0.1
Concentration (µg/kg)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent Detected
90th Percentile
percent detected
Mammal
Bird
Reptile
Fish
Amphibian
Crustacean
Egg
Terrestrial Invert
Aquatic Invert
Leafy Plant
Aquatic Plant
Inedible Plant
Root Vegetable
Fruit

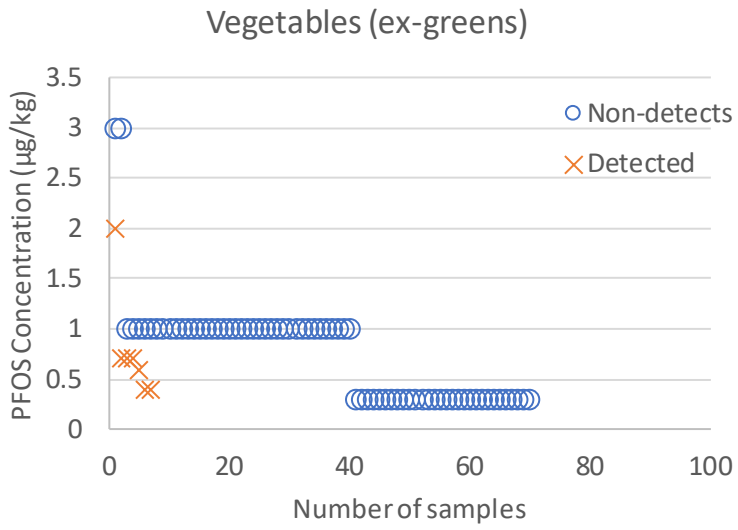
Intake by food type – Fish and aquatic invertebrates

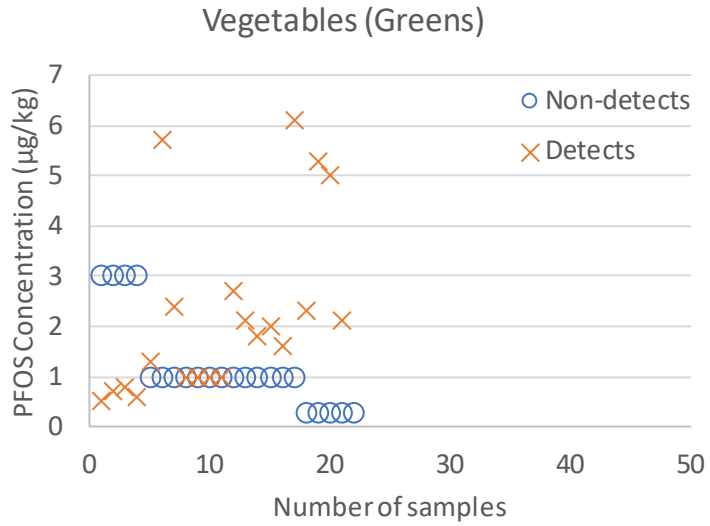




Intake by food type – Fruits and vegetables



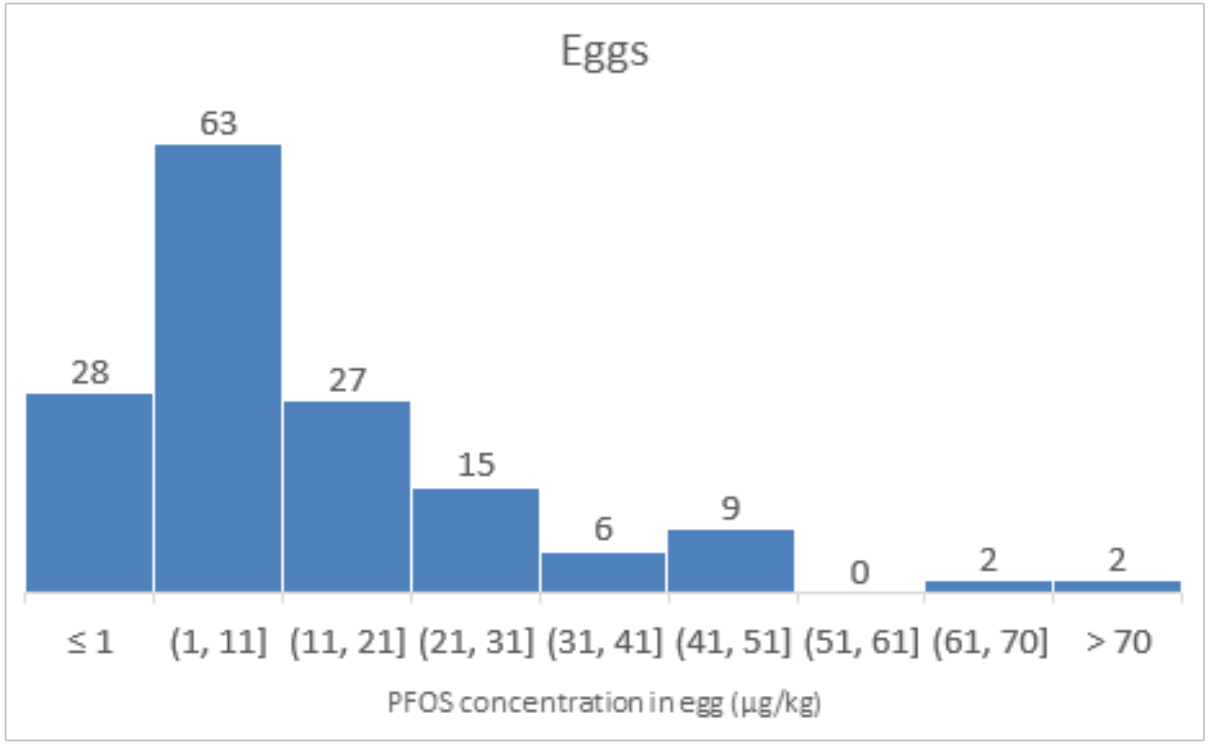




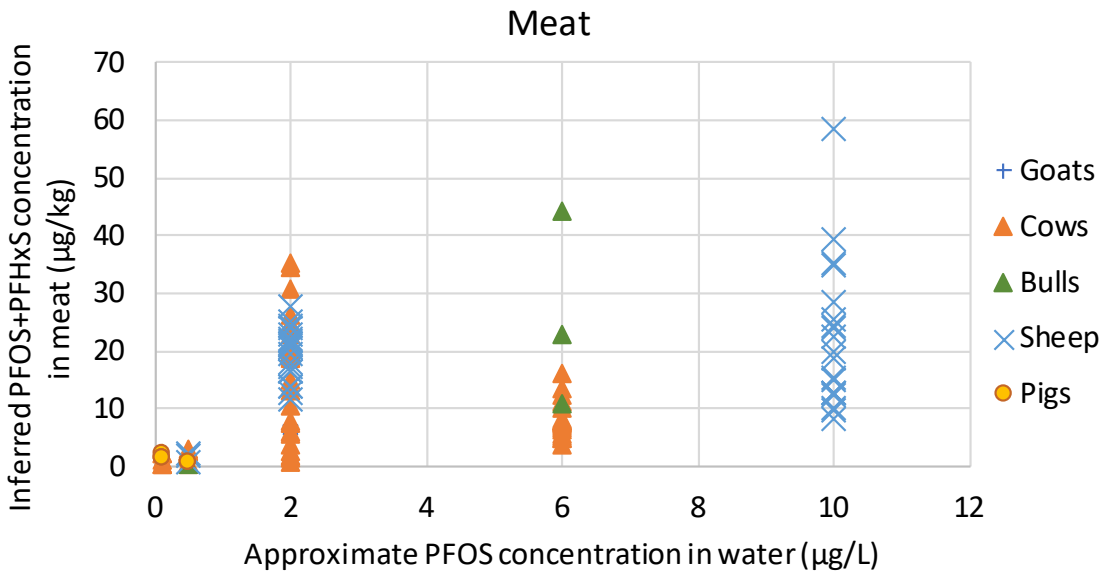
- Very rare detection in fruit
- Occasional low detection in root / tuber vegetables
- Frequent low detection in leafy greens, correlating with water concentration

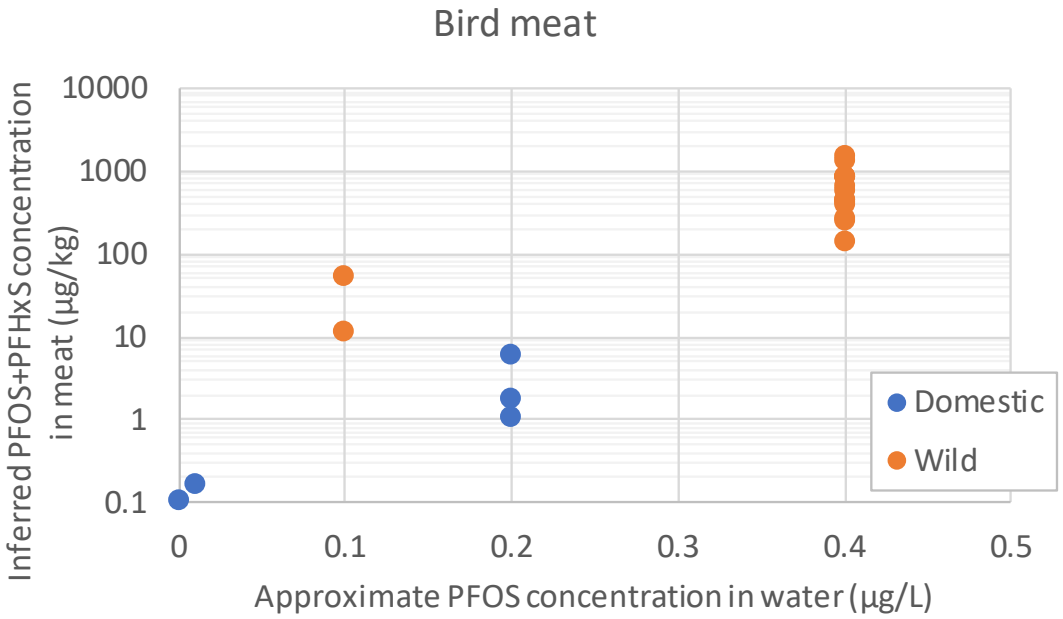
Intake by food type – Eggs

- Most samples detected PFOS
- PFOS dominant, but some PFHxS and traces of other long chain
- Unreliable correlation to water concentration
- Chicken behavior lends to high PFAS intake



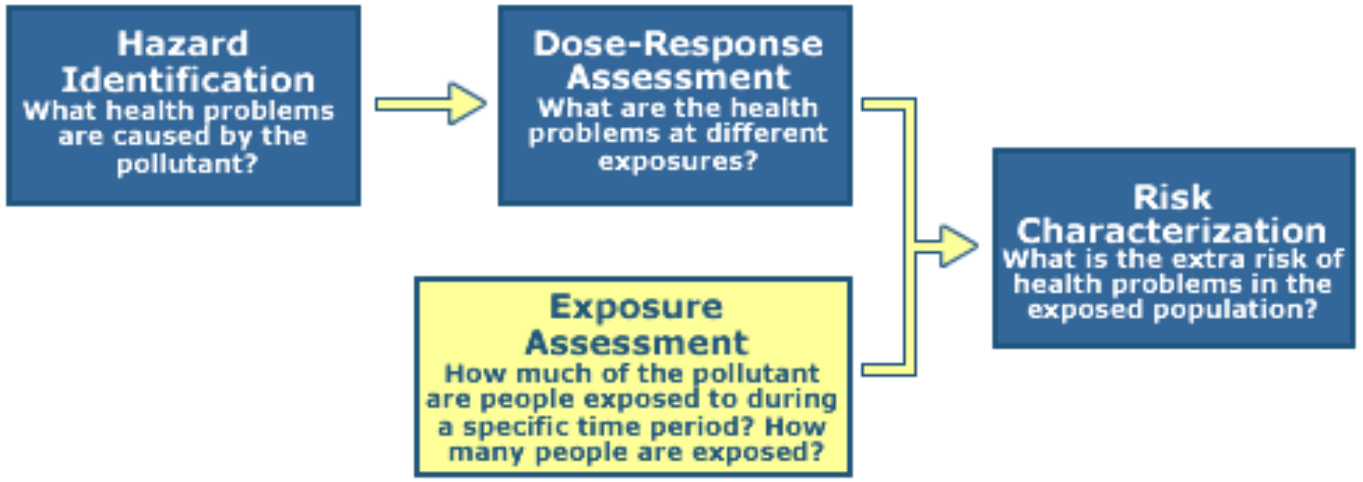
Intake by food type – Meats

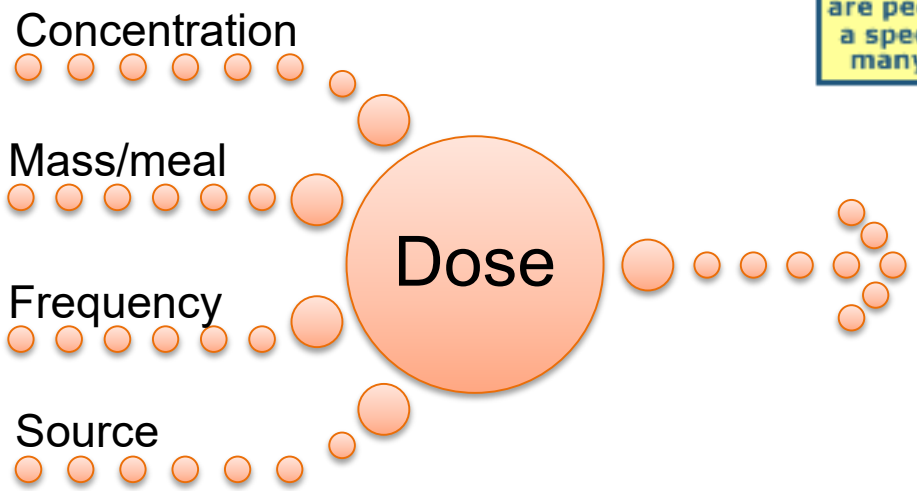




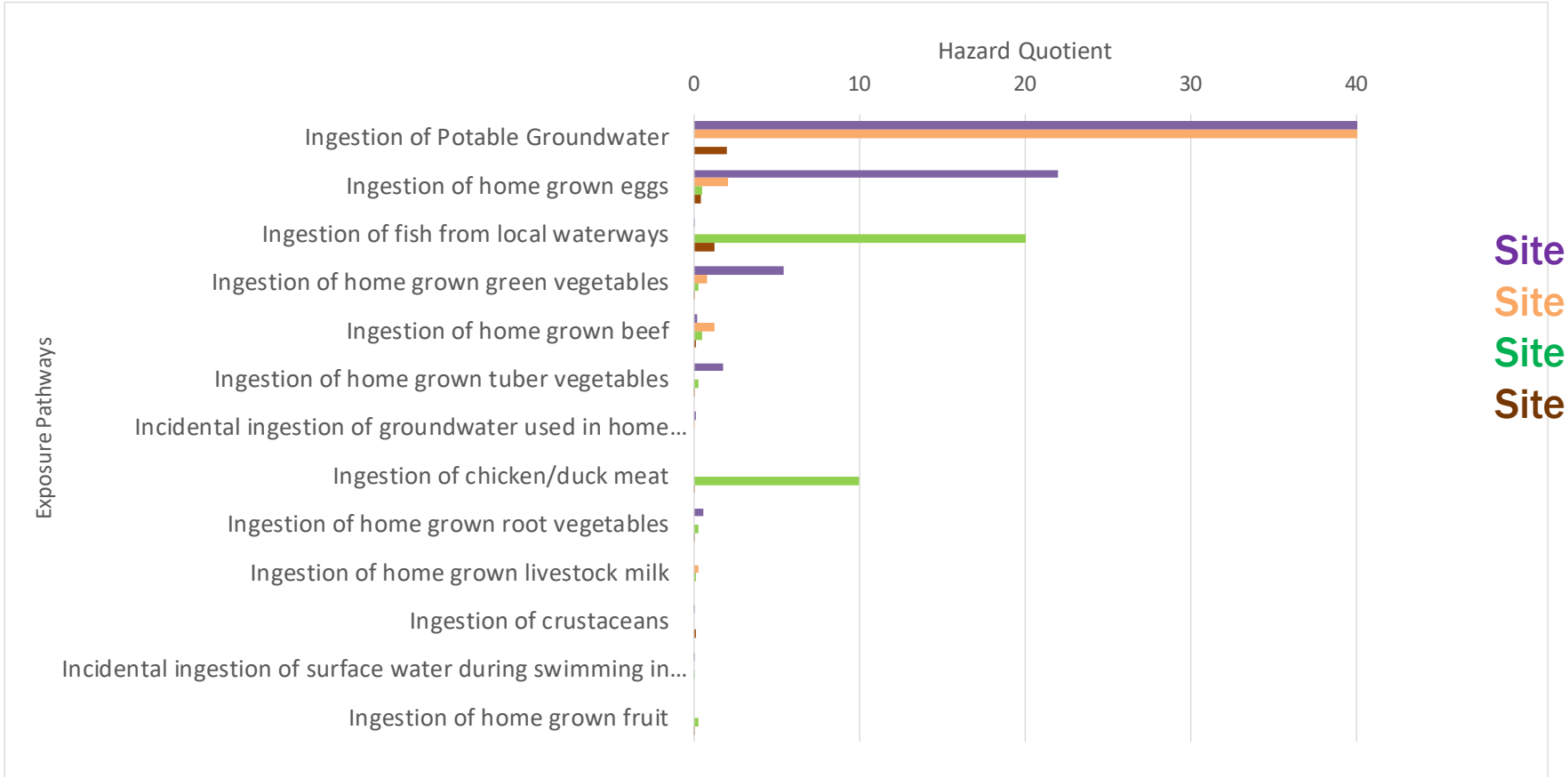
- PFOS and PFHxS dominant
- Detectable in most serum samples
- Reasonable correlation to associated water concentrations.
- Higher accumulation in birds than mammals.
- Domestic animals potential show lower concentrations than wild / feral animals

The 4 Step Risk Assessment Process





Risk drivers / Key exposure pathways



Drinking water → Eating poultry eggs, Eating aquatic biota → Eating home raised /wild meat, Eating home grown vegetables → Eating home grown fruit, Swimming, Non-potable domestic use

Summary

- Assumptions and communication about diet make a big difference to the apparent risk, and the community confidence in risk assessment
- Targeted biota testing can be useful to validate a conceptual site model, and refine a risk assessment
- Some food types have been consistently demonstrated to be low risk
- Home grown foods and locally caught foods can lead to an intake of PFOS above precautionary target levels in contaminated communities, under certain scenarios

Questions