Key Solutions

Vegi Tales

2005 RETS/REMP Workshop

Jim Key

Key Solutions, Inc.

www.keysolutionsinc.com

Branch Technical Position

… environmental monitoring program provides measurements of radiation and radioactive materials in those exposure pathways leading to the highest potential radiation exposures of individuals …

Branch Technical Position

- Defines Three Ingestion Pathways for Monitoring
  - Milk
  - Fish and Invertebrates
  - Food Products

Ingestion Pathways

Monitoring Medium	Liquid Releases	Gaseous Releases
Milk	Maybe (Irrigation)	Yes
Fish and Invertebrates	Yes	
Leafy Vegetation		Yes
Tuberous and Root Vegetation	Yes	

Branch Technical Position

"Samples from milk animals are considered a better indicator of radioiodine in the environment than vegetation."

WHY?

Bioaccumulation?

- No
  - Reg Guide 1.109 Bioaccumulation Factor for Iodine in Milk Very Small

$$6\times10^{-3}\ \frac{pCi/liter(milk)}{pCi/da(feed)}$$

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Hi-Volume Sampler

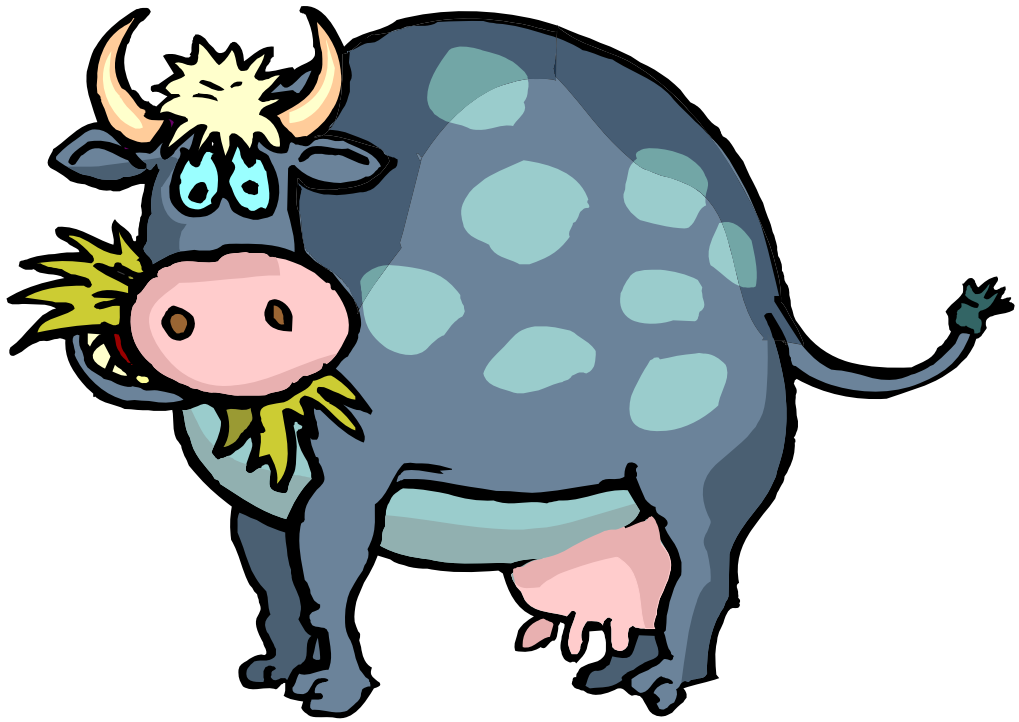
Regulatory Models Assume:

Consumption Rate:

50 Kg/day

Agricultural Productivity (Pasture Grass)

0.7 Kg/m^2



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Hi-Volume Sampler

Based on Models

71.43 m^2 grazed per day

Or

26,072 m^2 grazed per year

Or

6.4 acres grazed per year

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Low-Volume Sampler

Regulatory Models Assume:

Consumption Rate:

64 Kg/year

Agricultural Productivity (Leafy Vegetation)

2.0 Kg/m^2

Or

32 m^2 grazed per year

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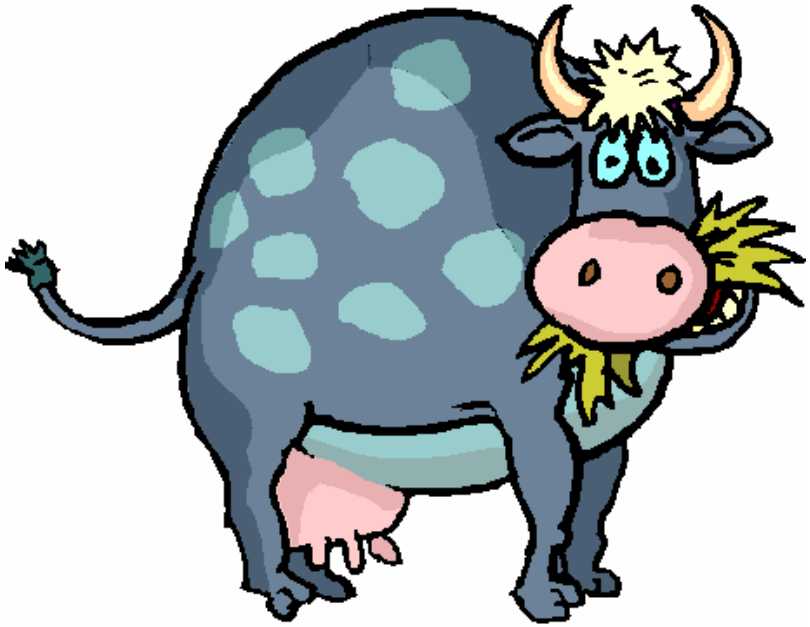
Hi-Vol vs Low-Vol Samplers



$$\frac{26{,}071\,m^2}{32\,m^2} \approx 800$$

Hi-Volume Sample

- True Grazed Area Significantly Lower
  - Typical Agricultural Productivity for Pasture Grass Higher Than RG 1.109 Value of 0.7 kg/m^2
  - Model Assumes Pasture is Non-Renewable
  - Some Supplemental Feeding is Likely
- In General - Most Sensitive Indicator

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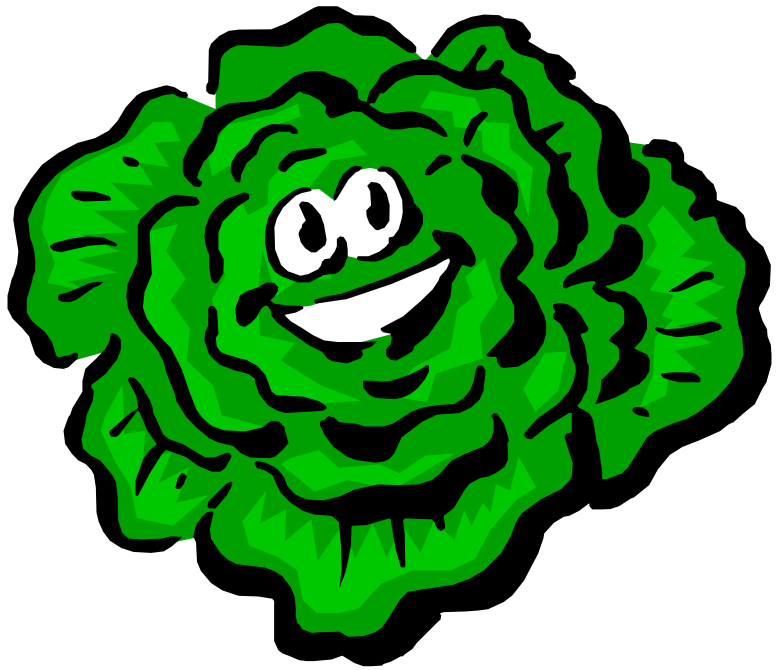
If No Milk Sampling Is Performed Then …



Must Sample Leafy Vegetation

Food Products

- Food Products From Area That is Irrigated by Water in Which Plant Wastes Have Been Discharged
  - Special Attention to be Paid to Tuberous and Root Food Products
- Broad Leaf Vegetation

Why the Distinction Between Broad Leaf and Other Vegetation?

- Broad Leaf Sampling
  - Monitoring Due to Atmospheric Releases
  - Only Significant Activity from Direct Atmospheric Deposition
  - If No Direct Atmospheric Deposition then Root Uptake Becomes Significant

RG 1.109 Concentration Predictions

Nuclide	Biv	Leaf/Root Ratio
Fe-55	6.6E-04	488
Co-60	9.4E-03	20
Sr-90	1.7E-02	6
I-131	2.0E-02	3792
Cs-137	1.0E-02	10

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Leafy Vegetation

- Required to Sample “Broad Leaf Vegetation”
- Three Different Kinds
- Two Different Locations With Highest Predicted D/Q
- Sampling to be Performed Monthly During Growing Season

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Vegetation Sampling Locations

- Alternate – In Lieu of Garden Census, Sample at Site Boundary in Two Different Sectors with Highest D/Q
- If Site Has Elevated Release Point, This Option Cannot Be Used … Why Not?

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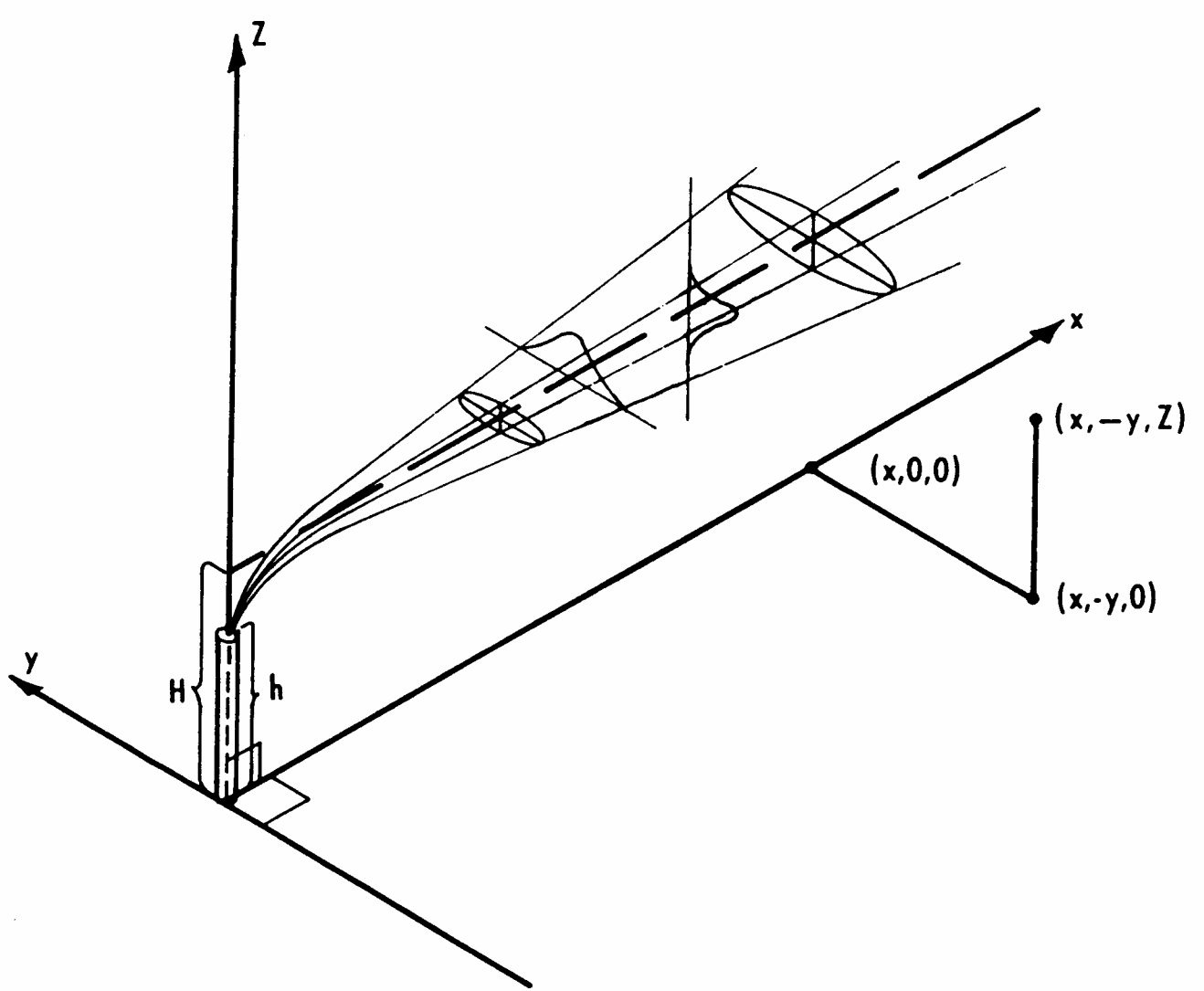
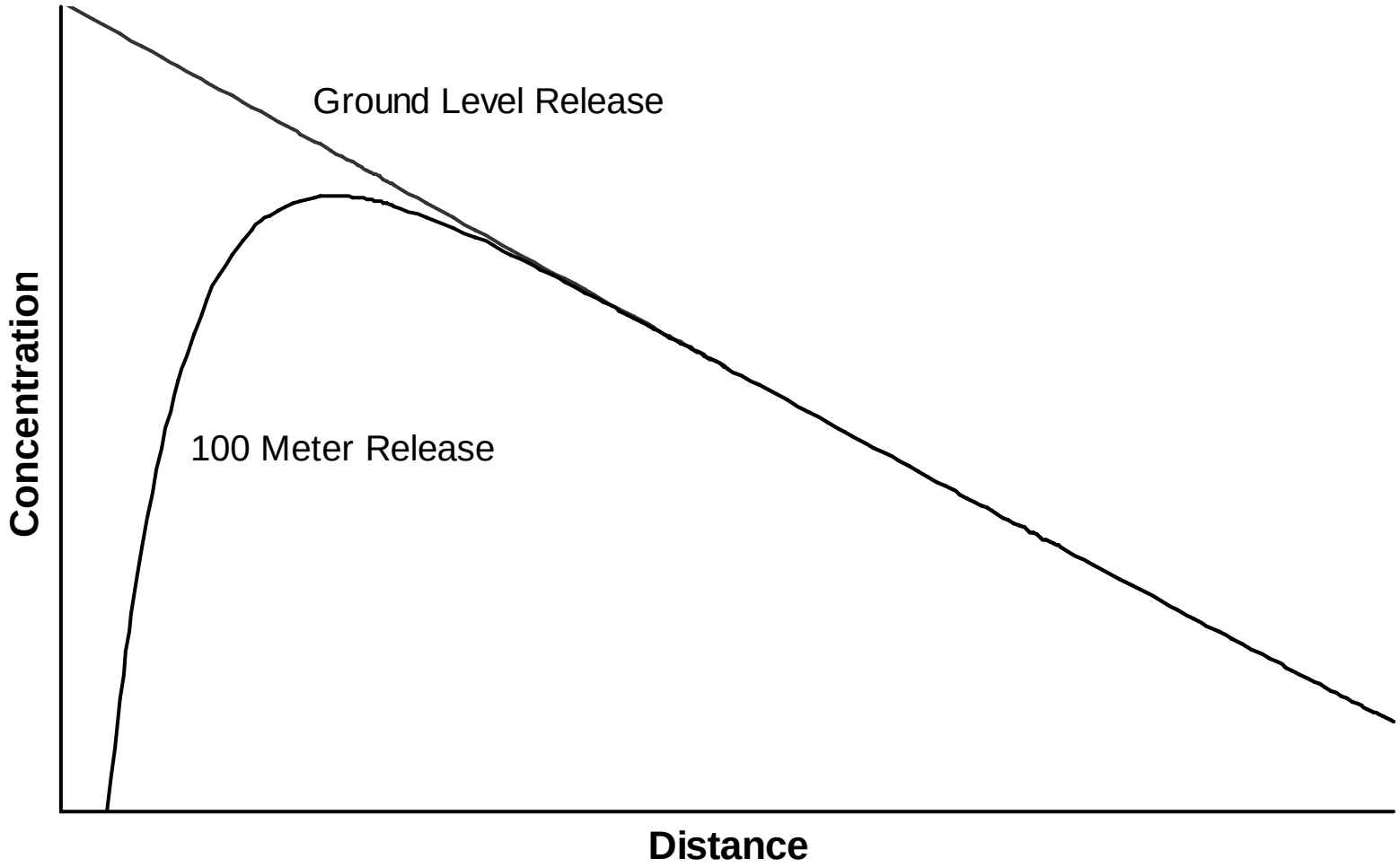
Gaussian Plume Model



Concentration vs. Release Height



Broad Leaf Vegetation

- Well-Defined Leaf Blades That Are Relatively Wide in Shape as Opposed to Needle-Like or Linear.
- Leaf Area is Typically Greater Than 1 Square Inch.

Leafy Vegetation

- NUREG 0472 – “similar to lettuce and cabbage”
- Also Turnips (leafy portion), Spinach, Celery

Broad Leaf Vegetation

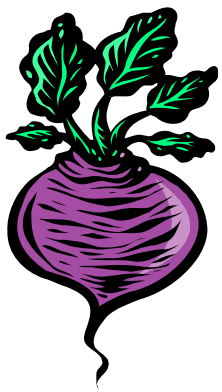
- Examples of Edible Broad Leaf Vegetation Where Leafy Portion Is Consumed
  - Cabbage, Lettuce, Turnips (the leafy portion), Spinach, Celery

Broad Leaf Vegetation

- Where access to green leafy vegetables from private gardens is not possible, non-edible plants with similar leaf characteristics from the same vicinity may be substituted. (Reg Guide 4.8)

Edible Broad Leaf Vegetation

- Examples of Edible Broad Leaf Vegetation Where Leafy Portion Is Not Consumed
  - Corn, Sugar Beet, Peas, Beans, Soybean, Potato, Cucumber, Kohlrabi, Tomato, Zucchini, Pokeweed



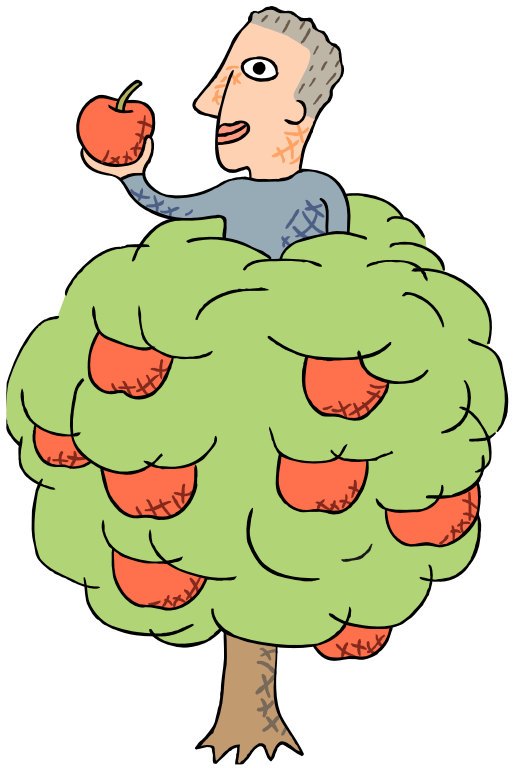
Non-Edible Broad Leaf Vegetation

- Examples of Non-Edible Broad Leaf Vegetation
  - Tobacco, Fast Growing Ornamentals (i.e. Perennials)
  - Avoid Slow Growing Plants Which Would Integrate Activity Over a Long Period
    - Trees
    - Shrubs
    - Moss
    - Lichens

Other Vegetation (Leafy and Non-Leafy)

- Slow Growing Plants Will Integrate Activity Over Long Period of Time (Sr-90 and Cs-137)
  - Moss & Lichens
  - Tree Leaves
  - Spanish Moss – Good Integrating Filter for Airborne Particulate
  - Not a part of human food chain, but potentially sensitive indicators.

Fruits and Root Vegetables



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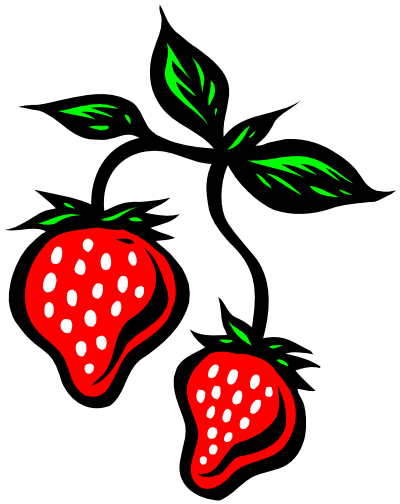
Food Products (Root Vegetables and Fruit)



Only if Irrigated by Water Likely to be Affected by Plant Discharges

Non-Leafy Vegetation Sampling

- Appropriate Where Deposition is Negligible
- Activity Expected to Arise From
  - Irrigation by Contaminated Water
  - Growth in Contaminated Soil

Food Products Sampled for Irrigation Monitoring

- At Harvest
- If Multiple Harvest
  - At Each Discrete Harvest
- If Harvest Is Continuous
  - Monthly During Growing Season

Food Products Sampled for Irrigation Monitoring

- Particular Attention to be Paid to Sampling
  - Tuberous
  - Root Food

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Does Not Qualify for Sampling

- Why Not?
  - Not Broad Leaf
  - Not Typical Ingestion Pathway
  - May Be Inhalation Pathway (Unless can Document “Did not inhale.”)

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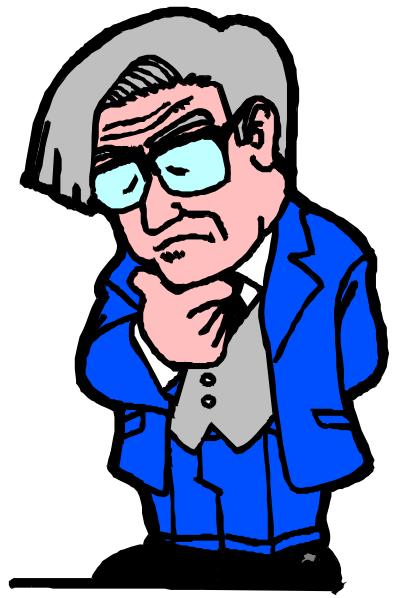
To Wash or Not to Wash?

- If You Are Washing, Don’t Stop
- If You Are Not Washing, Don’t Start
- Why?



To Wash or Not to Wash?

Food Processing Iodine Retention Factors (IAEA TRS 364)		
Plant	**Processing Method**	**Retention Fraction**
Spinach	Washing	0.2 – 0.9
	Cooking and Rinsing	0.4
Lettuce	Washing	0.1 – 0.5
	Remove Inedible Parts	0.1 – 0.5
Cabbage	Washing	0.4
	Remove Inedible Parts	0.5
	Cooking and Rinsing	0.2 – 0.5

Vegetation Sampling Locations

- Sample in Two Locations With Highest Predicted D/Q
  - Sample Member of Public Gardens
  - Sample Gardens Grown by Utility for Monitoring Purposes
- Don’t Forget Purpose of Broad Leaf Sampling – Monitoring of Direct Deposition

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What's Wrong With This Picture?