U.S. EPA Superfund Need for Research on Common Game Animals

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Clu-In Webinar on July 13, 2020
"Most Common Game Animals in the U.S and Information on Intakes, Habitation, Hunt Frequency, and Human Consumption"

Purpose

- Provide background for why EPA needed this research project on most common game animals
  - This includes a brief overview of CERCLA (Superfund) tools for assessing human consumption of game animals in risk assessments and dose assessment at radioactively contaminated sites
    - This talk does not address ecological protection

CERCLA Risk and Dose Calculators

Human Health - Radiological

Cancer risk (1×10^{-6})

- PRG (soil, water and air) 2002
- BPRG (inside buildings) 2007
- SPRG (outside surfaces) 2009

Dose (millirem per year)

- DCC (soil, water and air) 2004
- BDCC (inside buildings) 2009
- SDCC (outside surfaces) 2009

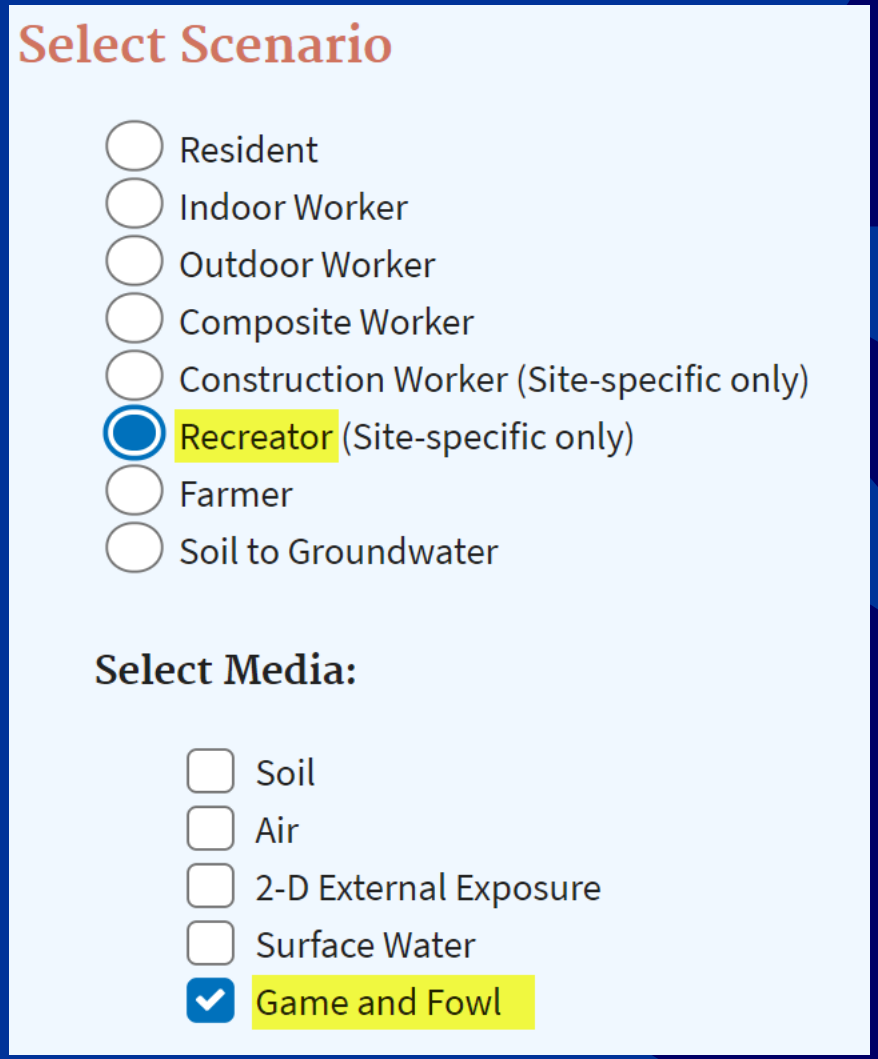
Human Health - Chemical

- RSL (soil, water, and air) 2008
- VISL (vapor intrusion) 2018

PRG and DCC – Recreator Scenario

- Extension of residential scenario.
- There are no default exposure parameters.
- Age-adjusted for change in intake as the receptor ages.
- Main pathways: soil, water, **wild game**, air

PRG and DCC – Recreator Scenario Selecting Game and Fowl Hunters



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PRG and DCC – Recreator Scenario
Game and Fowl graphical representation

PRG and DCC – Recreator Scenario
Game and Fowl Hunter characteristic inputs

Parameters Common to all Exposure Route Equations			
.	ED_{rec} (exposure duration - recreator) yr	.	EF_{rec-c} (exposure frequency - recreator child) day/yr
.	ED_{rec-a} (exposure duration - recreator adult) yr	.	ET_{rec} (exposure time - recreator) hr/day
.	ED_{rec-c} (exposure duration - recreator child) yr	.	ET_{rec-a} (exposure time - recreator adult) hr/day
.	EF_{rec} (exposure frequency - recreator) day/yr	.	ET_{rec-c} (exposure time - recreator child) hr/day
.	EF_{rec-a} (exposure frequency - recreator adult) day/yr	.	t_{rec} (time - recreator) yr

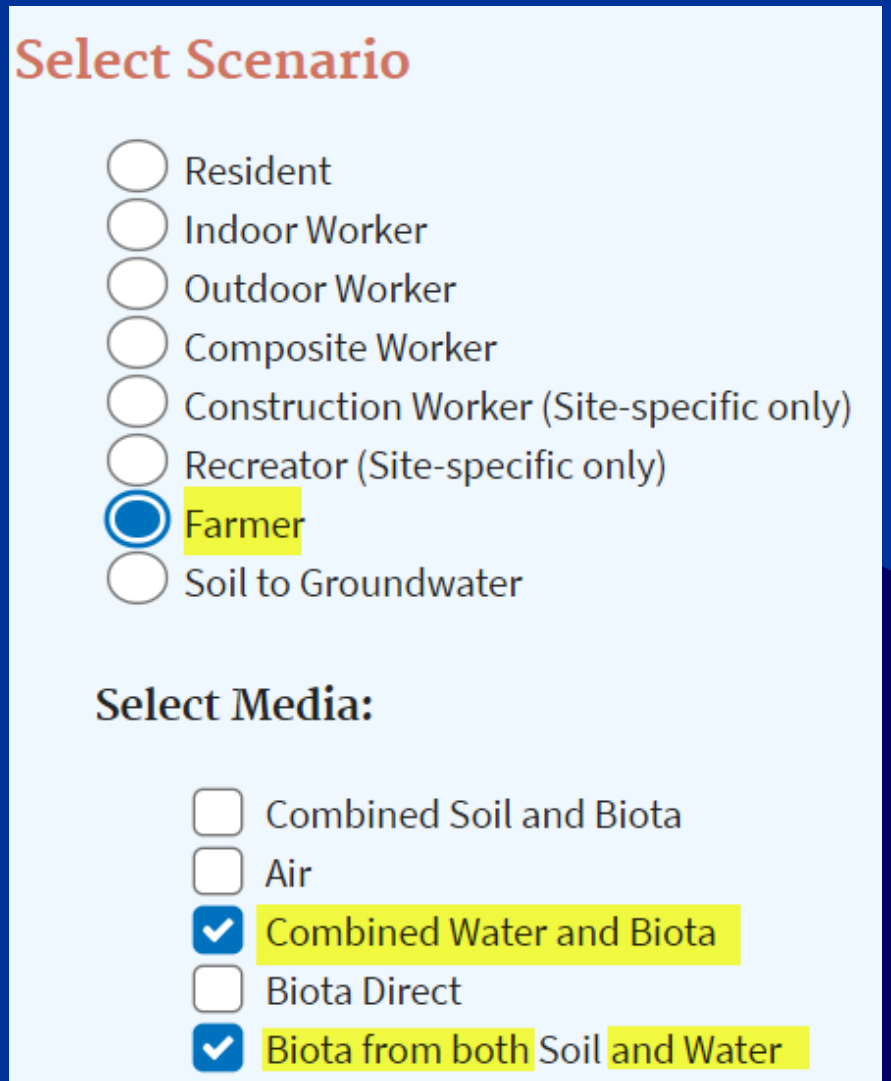
PRG and DCC – Recreator Scenario
Game and Fowl animal consumption rate inputs

1	$CF_{rec\text{-}fowl}$ (fowl contaminated fraction) unitless	0.25	$MLF_{pasture}$ (pasture plant mass loading factor) unitless
1	$CF_{rec\text{-}game}$ (game contaminated fraction) unitless	.	$Q_{p\text{-}fowl}$ (fowl fodder intake rate) kg/day
.	ED_{rec} (exposure duration - recreator) yr	.	$Q_{p\text{-}game}$ (land game fodder intake rate) kg/day
.	EF_{rec} (exposure frequency - recreator) day/yr	.	$Q_{s\text{-}fowl}$ (fowl soil intake rate) kg/day
1	$f_{p\text{-}fowl}$ (fowl on-site fraction) unitless	.	$Q_{s\text{-}game}$ (land game soil intake rate) kg/day
1	$f_{p\text{-}game}$ (land game on-site fraction) unitless	.	$Q_{w\text{-}fowl}$ (fowl water intake rate) L/day
1	$f_{s\text{-}fowl}$ (fraction of year fowl is on site) unitless	.	$Q_{w\text{-}game}$ (land game water intake rate) L/day
1	$f_{s\text{-}game}$ (fraction of year land game is on site) unitless	.	t_{rec} (time - recreator) yr
.	$IRGF_{rec}$ (fowl consumption rate) g/day	1E-06	TR (target cancer risk) unitless
.	$IRGL_{rec}$ (land game consumption rate) g/day		

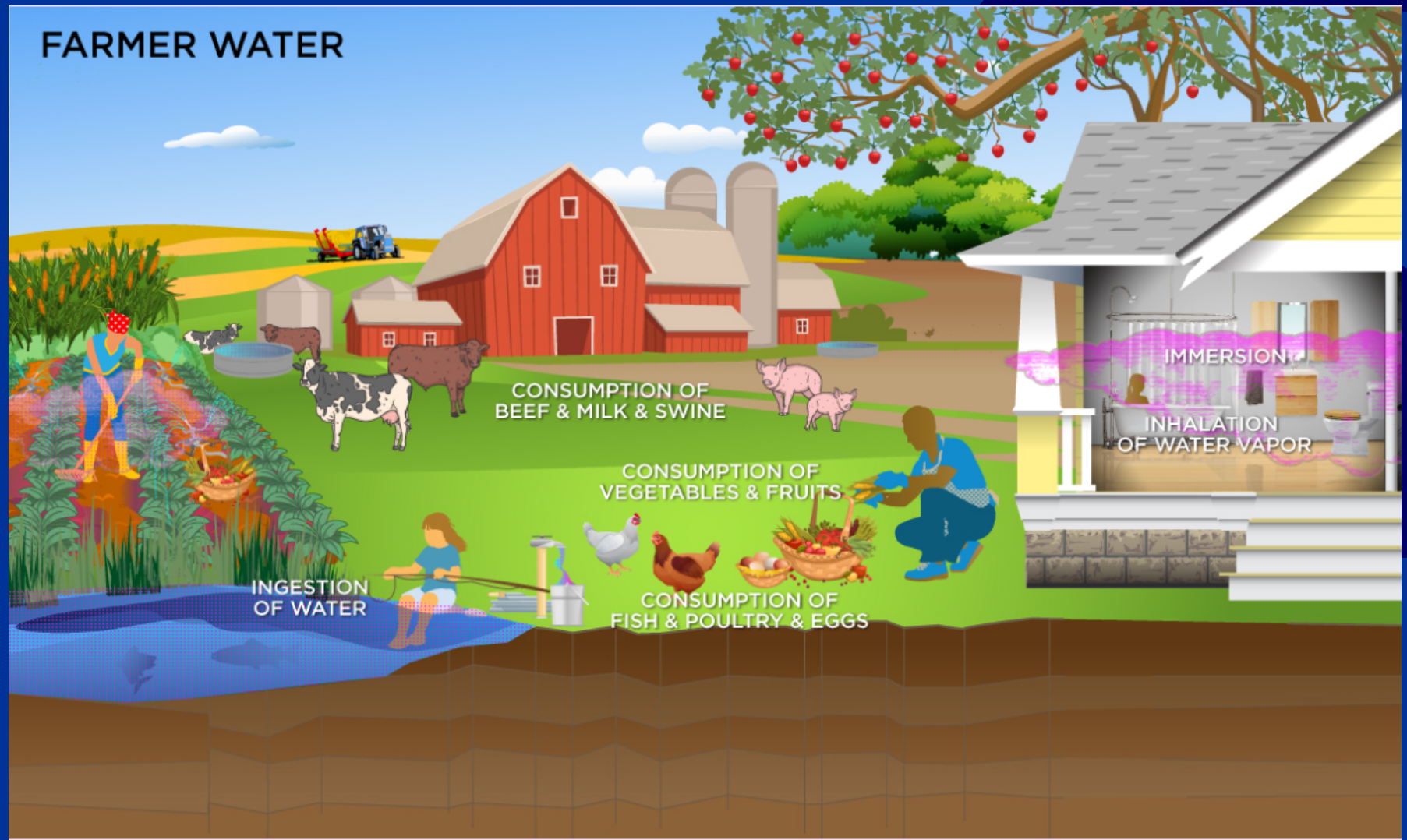
PRG and DCC – Farmer Scenario (water)

- Exposure pathways
  - » Incidental ingestion of water
  - » Inhalation of volatiles from water
  - » External exposure to ionizing radiation
  - » 100% homegrown produce and livestock consumption
    - —Meat (cattle, goat, sheep) – Swine
    - —Milk (cow, goat, sheep) – Eggs
    - —Poultry (chicken, goose, turkey and duck) – **Fish**
    - —Produce (24 categories)

PRG and DCC – Selecting Farmer Scenario (water)



PRG and DCC – Farmer Scenario (water) graphical representation



PRG and DCC – Farmer Scenario (water)
Fish pond related inputs

1	$CF_{far\text{-}fish}$ (fish contaminated fraction) unitless	831.8	$IRFI_{far\text{-}a}$ (fish ingestion rate - farmer adult) g/day
10018960	$IFFI_{far\text{-}adj}$ (age-adjusted fish ingestion factor) g	57.4	$IRFI_{far\text{-}c}$ (fish ingestion rate - farmer child) g/day

Radionuclide	Fish Bioconcentration Factor BCF (L/kg)		Soil-Water Partition Coefficient K_d (cm^3/g)
Ba-137m		1.20E+00	4.00E-01
Cs-137		2.50E+03	1.00E+01

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Existing approach may not be enough

- EPA Superfund program sometimes has site decisions and risk assessments based on recreational hunting scenarios
- Concerns have been raised that existing Superfund calculators do not capture common game animals eaten by recreators
  - This concern has also been echoed at the 35 all day classes EPA has conducted on radiation risk assessment
  - Previous comparison study of radiation models conducted by Nasser Shubayr for EPA found IAEA supported model NORMALYSA included game animals (e.g., moose, roe deer, wild boar)