

Highway 36/Triangle Lake Pesticide Exposure Investigation



COMMUNITY MEETING TO PROVIDE INFORMATION

ON ACTIVITIES OF THE

PESTICIDE

ANALYTICAL AND RESPONSE CENTER (PARC)

Investigation Team

State Agencies



Federal Agencies

ATSDR

- Western Branch
- Region 10 Office
- TPO
- Science Support Branch
- EI Group

EPA Region 10 Offices:

- Compliance & Enforcement, Pesticides and Toxics Unit
- Environmental Assessment, Risk Evaluation
- Ecosystems, Tribal & Public Affairs
- Oregon Operations

Scientific Inquiry



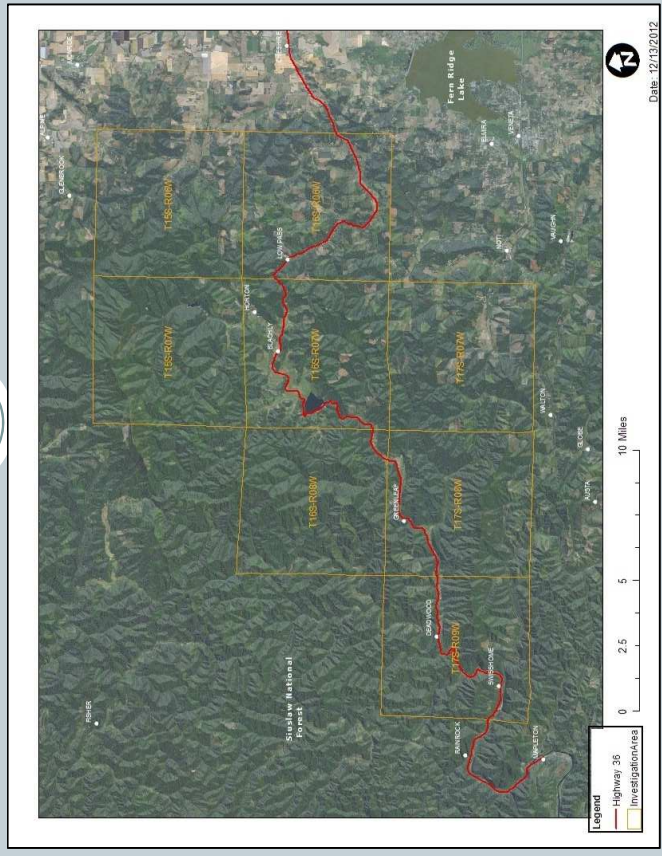
Research Study

- To test a prediction (hypothesis) which designates the relationship between two or more variables.
- Generalizeable – the degree to which the knowledge about the observed relationship is applicable to like circumstances

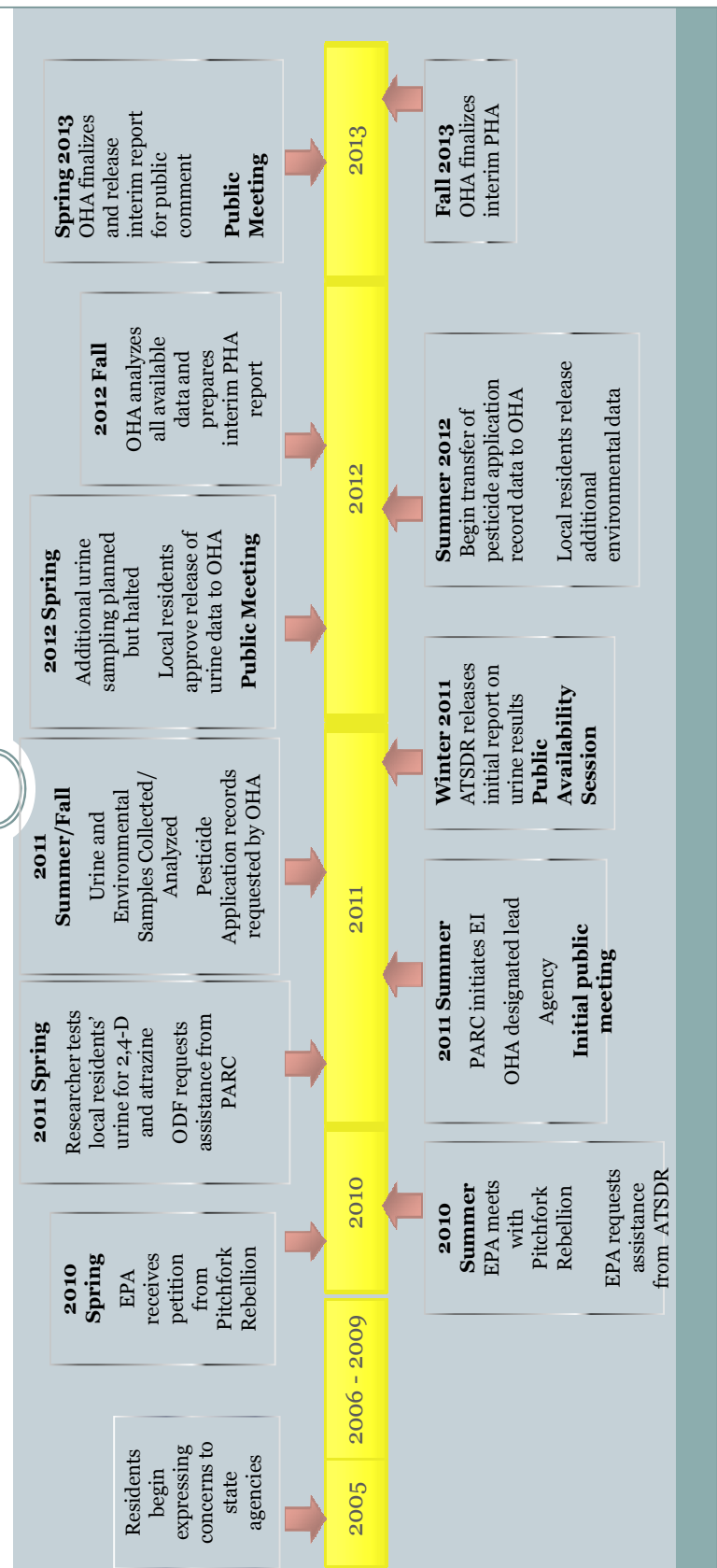
Exposure Investigation

- To determine whether people have been exposed to hazardous substances
 - to better characterize past, current, and possible future human exposures to hazardous substances and
 - to evaluate both existing and possible exposure-related health effects.

Hwy 36 Exposure Investigation Area

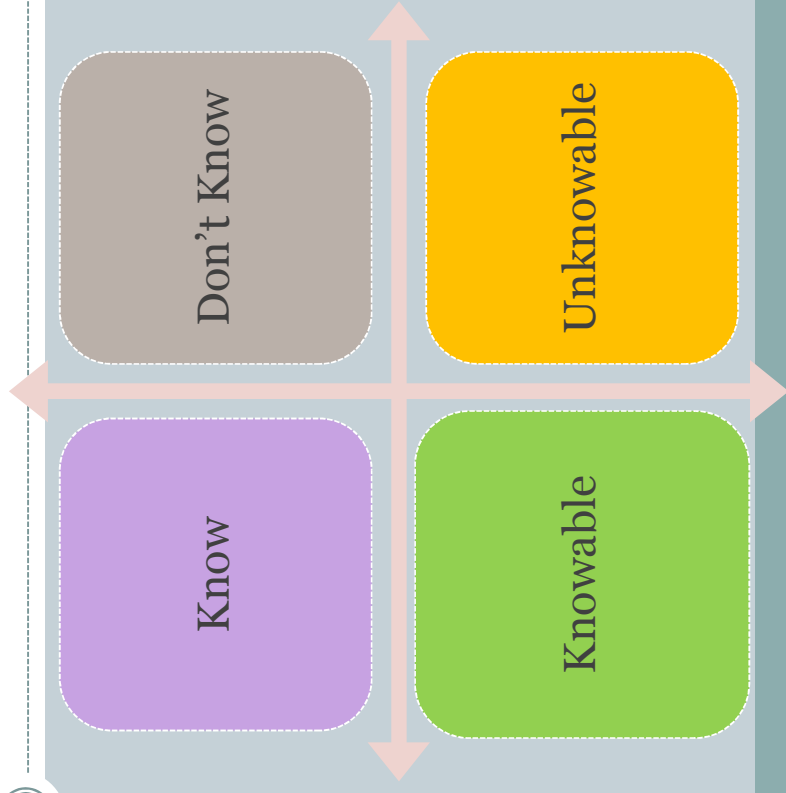


Exposure Investigation Timeline to Date



Exposure Investigation Questions: Where are we?

- Are residents in the Highway 36 Corridor being exposed to pesticides from local application practices?
 - To what pesticides are they being exposed?
 - To what levels are they being exposed?
 - What are potential source(s) of the pesticides to which they are exposed?
 - What are potential routes (pathways) of residents' exposures?
 - What health risks are associated with these exposures?



PHA Conclusions

**Are residents in the Highway
36 Corridor being exposed to
pesticides from local
application practices?**

PHA Conclusions

Are residents in the Highway 36 Corridor being exposed to pesticides from local application practices?

- **Conclusion 1:** This investigation found evidence that residents of the investigation area were exposed to pesticides or herbicides in spring and fall 2011. However, it was not possible to confirm if these observed exposures occurred as a result of local application practices or were from other sources.

ATSDR and Community Collected Urine Results



Spring 2011 Community Collected Samples (n=39)

Contaminant	Mean* (Range)	25 th Percentile	50 th Percentile	75 th Percentile	95 th Percentile
2,4-D	4.9 (0.7-31.7)	2.2	5.0	11.7	25.6
Atrazine equivalents [†]	5.0 (0.6-62.1)	2.4	4.8	11.4	29.8

* Mean is geometric mean; † Atrazine equivalents reflect the sum of measurements of the metabolites diaminochlorotriazine (DACT), desethyl atrazine (DEA), di-dealkylated-atrazine mercapturate (DAAM)
2,4-D = 2,4-dichlorophenoxy acetic acid

Comparison of spring 2011 samples to fall 2011 ATSDR samples

Contaminant	Spring 2011 Mean* (µg/L) (N=39)	Fall 2011 Mean* (µg/L) (N=64)	Mann-Whitney U Test (P Value)
2,4-D	4.9	0.37	<0.0001
Atrazine equivalents	5.0	None detected	-

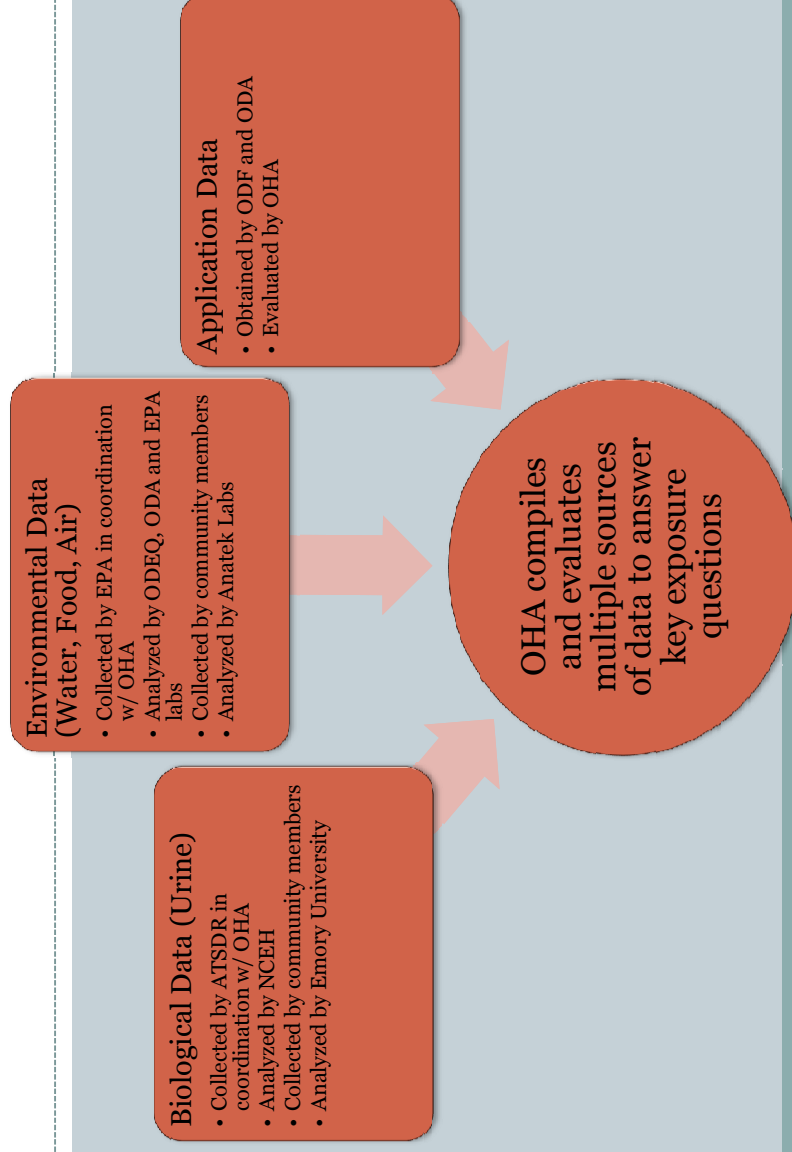
* Geometric mean; µg/L = micrograms per liter; 2,4-D = 2,4-dichlorophenoxy acetic acid

PHA Conclusions



To what pesticides are they being exposed?

Data collection and agency roles



Fall 2011 Environmental Sampling Results

Location	Sample Type	Analytes Detected	Analyte Concentration (ppm)	Health-based Screening Value (ppm)	Source of screening value
Household 1	Domestic well water	DEET	0.0000047	0.2	Derived*
Household 2	Domestic spring water	Hexazinone	0.000183	0.2	HBSL
Household 3	Domestic well water	Fluridone	0.000031	0.4	HHBP
Little Lake	Surface water	DEET	0.0000058	1	Derived*
Household 4	Soil	Glyphosate	0.081	5,000	RMEG
	Soil	2,4-D	0.046	500	RMEG
Household 5	Soil	2,4-D	0.014	500	RMEG
Household 6	Soil	Glyphosate	3.3	5,000	RMEG

ppm = parts per million; DEET = *N,N*-Diethyl-3-methylbenzamide; HBSL = U.S. Geological Survey Health Based Screening Level; HHBP = U.S. Environmental Protection Agency Human Health Benchmark for Pesticides; RMEG = Reference dose Media Evaluation Guide; 2,4-D = 2,4-dichlorophenoxy acetic acid

* Derived using Agency for Toxic Substances and Disease Registry methodology and Reference Dose developed by Minnesota Department of Health (0.33 mg/kg-day) [23]

Community Collected Environmental Data



Air Samples – June 2012

Collection Date	Detections/ Valid Samples	Analytes Detected	Maximum Analyte Concentration Detected (ng/m ³)	Health-based Screening Value (ng/m ³)	Source of screening value
May 2012	1/4	Clopyralid	0.37	525,000	Derived RfC*

ng/m³ = nanograms per cubic meter; 2,4-D = 2,4-dichlorophenoxy acetic acid; RfC = Reference Concentration
*Derived from the U.S. Environmental Protection Agency's oral reference dose for clopyralid [42]

Community Collected Environmental Data



Water Samples – Spring 2011

			Analytes (ng/POCIS)						
Sample Location	Deployment Dates	Lab Analysis Date	2,4-D	Atrazine	Desethyl Atrazine	Desisopropyl Atrazine	Hexazinone	Trichloropyridinol	Triclopyr
Fish Creek Near Mouth	4/17/2011-5/15/2011	9/8/2011	ND	52.3	15.9	ND	50.7	ND	ND
Fish Creek Near Mouth (Duplicate)	4/17/2011 - 5/15/2011	5/15/2012	NR	93	26.7	NR	81	NR	NR
Lake Creek Upstream of Fish Creek	4/17/2011 - 5/15/2011	9/8/2011	ND	15.8	0.9	ND	9.3	ND	ND
Congdon Creek a quarter mile from mouth	4/23/2011 - 5/21/2011	9/8/2011	ND	1.9	ND	ND	3.6	ND	ND
Unnamed drainage to Congdon Creek	4/23/2011-5/21/2011	9/8/2011	ND	ND	ND	ND	ND	ND	ND
Nelson Creek downstream of Almaise Creek	6/3/2011 - 7/3/2011	9/8/2011	ND	ND	ND	ND	ND	ND	ND
Nelson Creek downstream of Almaise Creek (duplicate)	6/3/2011-7/3/2011	5/15/2012	NR	ND	ND	NR	16.8	NR	NR
ng = nanograms; POCIS = Polar Organic Chemical Integrative Samplers; ND = Not detected; NR= Not reported; 2,4-D = 2,4-dichlorophenoxy acetic acid									

ng = nanograms; POCIS = Polar Organic Chemical Integrative Samplers; ND = Not detected; NR= Not reported; 2,4-D = 2,4-dichlorophenoxy acetic acid

PHA Conclusions

To what pesticides are they being exposed?

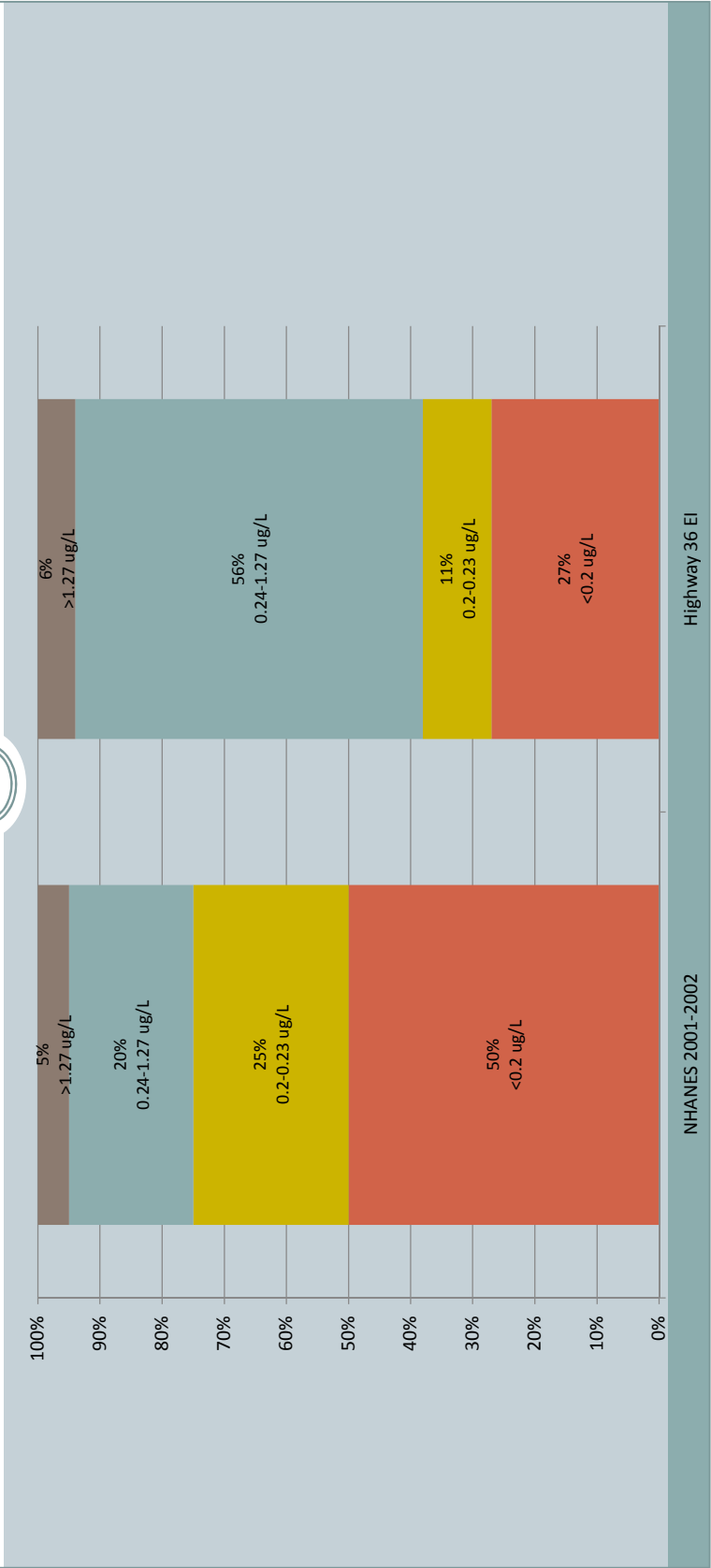
- **Conclusion 2:** Residents in the Highway 36 investigation area had urinary biomarkers for exposure to 2,4-D in spring and fall 2011, and atrazine in spring 2011. We were unable to determine if participants in the investigation had urinary biomarkers for exposure to pesticides other than 2,4-D and atrazine in spring or fall 2011.
- **Conclusion 3:** Some Highway 36 investigation area residents may have been exposed to very low levels of DEET, fluoridone, or hexazinone in their drinking water.
- **Conclusion 4:** Some Highway 36 investigation area residents may have been exposed to very low levels 2,4-D or glyphosate in their soil.
- **Conclusion 5:** Some Highway 36 investigation area residents may have been exposed to very low levels of clopyralid in the air.

PHA Conclusions



**To what levels
are they being
exposed?**

NHANES vs. Highway 36 EI – Fall 2011 Samples



Atrazine Comparison



Study	Population	Median atrazine equivalents (µg/L)	Metabolites measured	Range (µg/L)
French women's study	Pregnant women in Brittany region of France (N = 579)	1.2 [‡]	DEA, DACT, DIA, atrazine mercapturate	ND – 17.1
Barr study	Individuals with occupational* exposures (N = 8)	Not reported	DEA, DIA, DACT, DAAM, ATZ, ATZ-OH, DEA-OH	100-510
	Individuals with non-occupational exposures (N = 5)	Not reported		10-235
Hwy 36 Spring 2011 Data	Participants in Spring 2011 Community-Collected Data (N = 39)	4.8	DEA, DACT, DAAM	0.6-62.1

µg/L = micrograms per liter, DEA = Desethyl atrazine, DIA = desisopropyl atrazine, DACT = Diaminochlorotriazine, DAAM = Didealkylated atrazine mercapturate, ATZ = atrazine, ATZ-OH = hydroxy atrazine, DEA-OH = hydroxy desethyl atrazine, N = number, ND = non-detect

[‡] Median among detected values; *Commercial lawn care applicators

PHA Conclusions

To what levels are they being exposed?

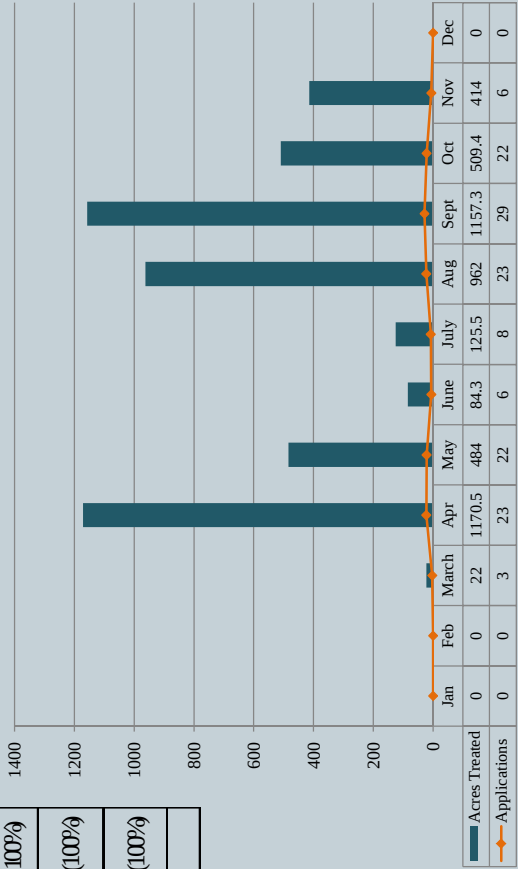
- **Conclusion 6:** In the spring of 2011, Highway 36 investigation area residents had higher levels of 2,4-D exposure than the general U.S. population.
- **Conclusion 7:** In the fall of 2011, Highway 36 investigation area residents had urinary 2,4-D levels that were not statistically different than the general U.S. population.
- **Conclusion 8:** In the spring of 2011, urine samples from Highway 36 investigation area residents also had detectable levels of atrazine, but it is unknown how these levels compare to the general U.S. population.



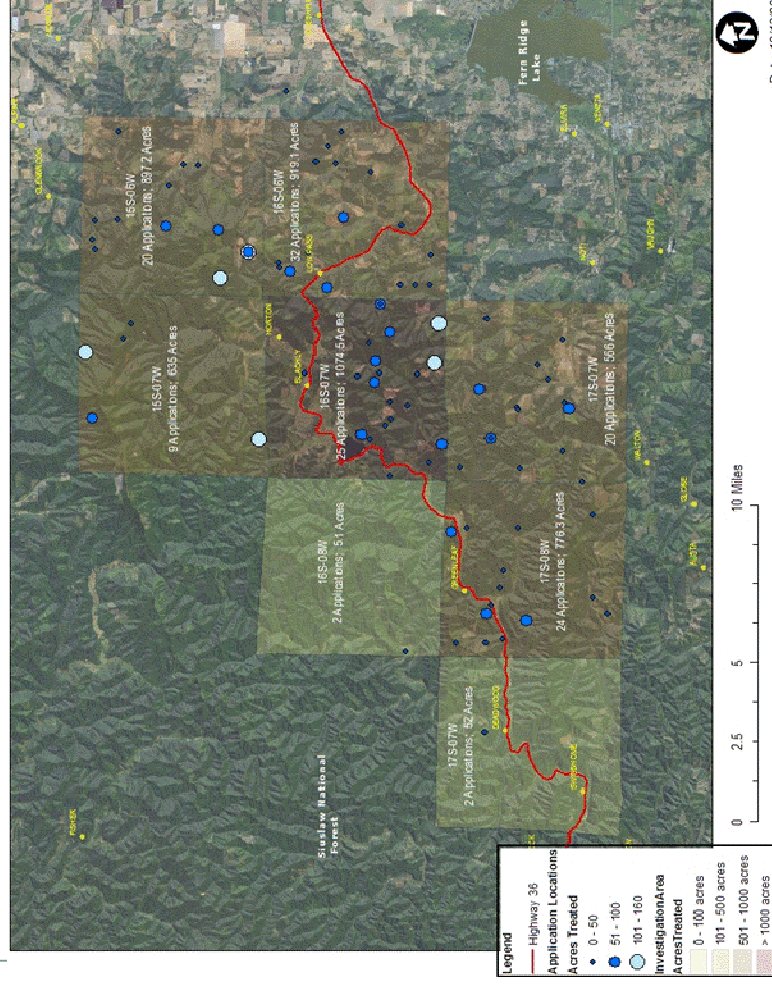
**What are potential
source(s) of the
pesticides to which they
are exposed?**

January – December 2011 Application Record Data

	Agricultural	Forestry	Roadside	Total
Applications	10 (7.0%)	114 (80.3%)	18 (12.7%)	142 (100%)
Acres Treated	90 (1.8%)	4,756 (95.5%)	88 (1.7%)	4,929 (100%)
Amount pesticides applied (gallons)	1286 (60%)	1972.4 (91.5%)	53.5 (2.5%)	2154.5 (100%)
Amount pesticides applied (pounds)	600 (4.3%)	1345.9 (95.7%)	0.0 (0.0%)	1405.9 (100%)
% = percent				



Timing and Location of Applications

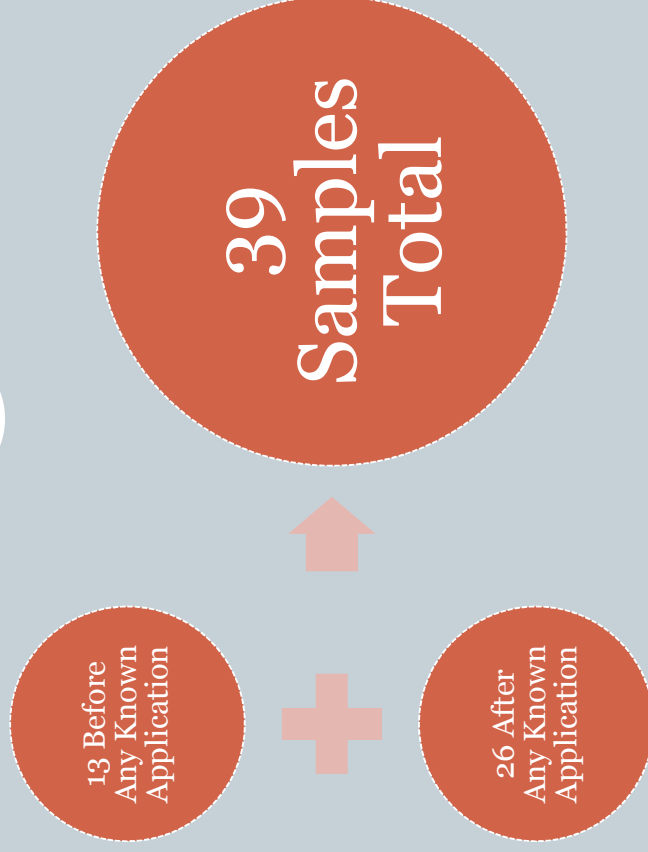


Date: 12/13/2012

Active Ingredient	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
2,4-D (gal)		325.4	20.0							345.4
Aminopyralid (gal)		1.5			0.6	2.7	0.5			5.3
Aminopyralid, Triclopyr (gal)			5.1	1.2	1.5					7.8
Atrazine (gal)		672.6	29.0							701.6
Clopyralid (gal)		10.8	2.1							12.9
Glyphosate (gal)	1.0	2.5	22.0	12.8	16.5	202.4	330.9	121.4		709.5
Hexazinone (gal)		38.6	11.2							49.8
Hexazinone (lbs)	44.0	745.8	514.2							1304.0
Imazapyr (gal)			0.3		1.1	42.6	140.4	37.2	30.0	251.5
Mesulfuron methyl (gal)						0.1	0.9	0.2		1.3
Mesulfuron methyl (lbs)						5.8	22.6			28.3
Sulfometuron Methyl (gal)	0.1					3.8	0.6	4.0		8.6
Sulfometuron Methyl (lbs)		2.0	0.3							2.3
Sulfometuron methyl, Mesulfuron methyl (gal)						3.3				3.3
Sulfometuron methyl, Mesulfuron methyl (lbs)							71.3			71.3
Triclopyr (gal)			0.5	1.3	21.8	24.6	8.6	0.8		57.5
Total (gal)	1.1	1051.5	90.1	15.3	41.4	279.5	482.0	163.5	30.0	2154.5
Total (lbs)	44.0	747.8	514.5	0.0	0.0	5.8	93.9	0.0	0.0	1405.9

*Notes: Excludes carriers and adjuvants. One application of glyphosate and sulfometuron methyl in March, and one application of glyphosate and triclopyr in August were missing data on the amount applied. Gal = gallons; lbs = pounds.

Analyses of Community Collected Urine Samples and Pesticide Application Data



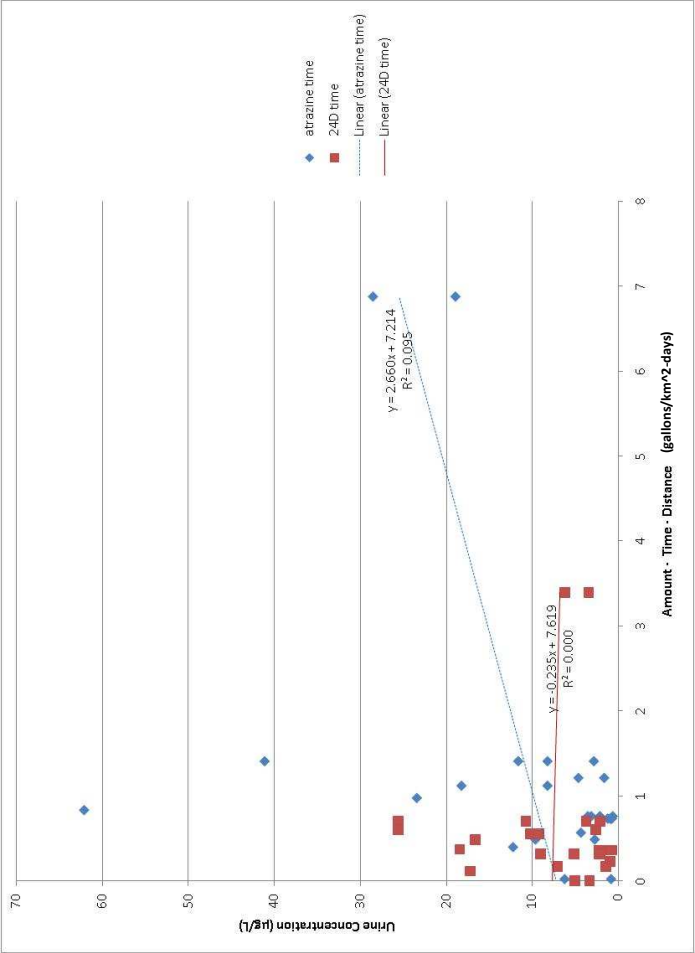
Urine Data Analyzed



Group	Mean* Atrazine Concentration (µg/L)	P Values	Mean* 2,4-D Concentration (µg/L)	P Values
13 Samples Before Any Known Application	5.3	0.72	5.4	0.63
26 Samples Anytime After Known Application	4.8		4.7	
9 Samples within 24 Hours of Known Application	10.0	0.045	7.2	0.2312
30 Samples Not within 24 Hours of Known Application	4.0		4.4	

*Geometric Mean

Urine Data Analyzed





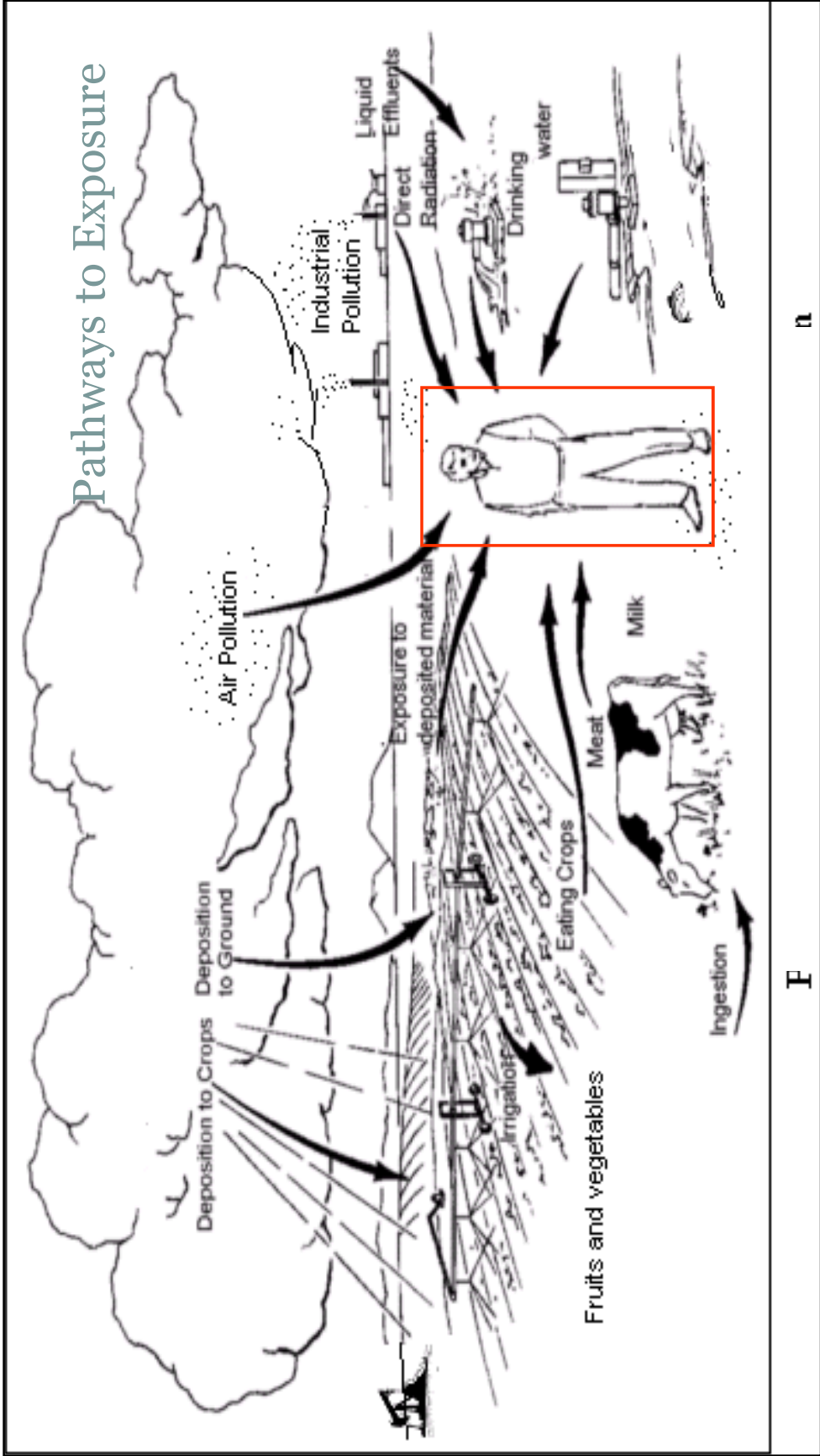
What are potential source(s) of the pesticides to which they are exposed?

- **Conclusion 9:** There is insufficient information to confirm that local pesticide applications are the source of pesticides found in the urine of participating Highway 36 investigation area residents. However, available evidence suggests it is possible that reported applications may have contributed to the levels detected in participants' urine.
- **Additional Conclusion:** There is insufficient information to identify potential sources of pesticides to explain urine concentrations of atrazine metabolites detected prior to reported applications.



**What are potential routes
(pathways) of residents'
exposures?**

Pathways to Exposure



Exposure Pathways Considered

Pathway	Source/Release*	Transport in environment (Media)	Point of Exposure	Route of Exposure	Exposed Population	Time
Air-borne particles	Aerial applications of pesticides and pressured ground sprays	Movement (drift) of chemicals off application sites (Air)	Outdoor air, indoor air	Breathing in chemicals in air	People who live or work near application areas	Past, present, future
Volatilized chemical vapors	Applications of pesticides	Volatilization of chemicals from soil to air (Air)	Outdoor air, indoor air	Breathing in chemicals in air	People who live or work near application areas	Past, present, future
Surface Soil	Applications of pesticides	Deposition of chemicals on surface soil (Soil)	Soil in gardens, yards	Swallowing, absorbing through skin	Gardeners, farmers, outdoor workers who have contact with surface soil	Past, present, future
Home-grown foods	Applications of pesticides	Deposition on, or uptake of, chemicals in garden vegetables, milk, eggs, etc. (Food)	Garden vegetable, milk, eggs, etc.	Eating	People who eat home-produced foods	Past, present, future
Drinking water	Applications of pesticides	Movement of chemicals through soil to groundwater or over land to surface water (Groundwater, surface water)	Tap	Drinking	Residents and other people who drink water from private ground/surface water sources	Past, present, future



What are potential routes (pathways) of residents' exposures?

- **Conclusion 10:** We were unable to determine whether air is a pathway of exposure to pesticides in the Highway 36 investigation area.
- **Conclusion 11:** Drinking water can be eliminated as an exposure pathway for the 2,4-D and atrazine detected in Highway 36 investigation area residents' urine.
- **Conclusion 12:** Soil sampled in the fall of 2011 can be eliminated as an exposure pathway for the 2,4-D and atrazine detected in Highway 36 investigation area residents' urine.
- **Conclusion 13:** Homegrown food sampled in the fall of 2011 can be eliminated as an exposure pathway.

PHA Conclusions

What health risks are associated with these exposures?

- **Conclusion 14:** The levels of 2,4-D measured in Highway 36 investigation area residents' urine in spring and fall 2011 were below levels expected to harm people's health.
- **Conclusion 15:** We cannot determine whether the levels of atrazine metabolites measured in Highway 36 investigation area residents' urine in spring 2011 could harm people's health.
- **Conclusion 16:** Drinking or contacting domestic water with the concentrations of pesticides detected in some Highway 36 investigation area properties is not expected to harm people's health.
- **Conclusion 17:** Contact with soil containing pesticides at the concentrations detected in the fall of 2011 in some Highway 36 investigation area soil is not expected to harm people's health.
- **Conclusion 18:** Handling or consuming garden vegetables, berries, eggs, milk or honey from the Highway 36 investigation area from fall 2011 will not harm people's health.

PHA Conclusions



What health risks are associated with these exposures?

Comparison Values for 2,4-D and Atrazine



Biomonitoring Equivalents vs. Reference Doses

Health Outcome Data Review Requirements

- the presence of a completed human exposure pathway
- a known time period of exposure
- a quantified population that was (or is being) exposed
- sufficient contaminant levels and time to result in health effects, and
- the availability of systematically collected HOD for the health outcomes associated with chemicals in the pathway

Uncertainties & Limitations

- While community-collected urine and environmental samples are of sufficient quality to include in this PHA, these samples were not collected or analyzed with the same level of oversight as the fall 2011 samples collected by government agencies.
- Conclusions can only be drawn about the pesticides that were tested for in urine and environmental samples.
- Conclusions about exposure and health risks only apply to the times when samples were collected by community members or the investigation team.
- It is not known if the Exposure Investigation resulted in changes to pesticide application practices in the investigation area, and therefore if exposure conditions have changed for Highway 36 corridor residents.
- There is insufficient scientific evidence to determine the effect of exposure to multiple pesticides at low doses.

PHA Conclusions

OHA reached *two* additional conclusions related to the impacts to the EI and to the health of community members from community conflict.

- **Conclusion 19:** Divisions and hostility among community members, fueled by cultural and values differences over land use, pesticide use and property rights, are creating significant stressors on many individual community members and on the community as a whole.
- **Conclusion 20:** Leadership activity within the community has been oriented toward debating issues of land use, pesticide use, and property rights. No formal or informal leader has yet emerged who has a mediating influence on these differences. Formal mediation services for the Hwy 36 community may be necessary for both the successful completion of the EI and for the important progress needed to reduce community stress and improve community cohesion in the longer term.

What is Still Unknown?

- Whether environmental sources (soil, surface water or locally grown food) are a source of exposure during the winter/spring season
- What the source of exposure was to explain the higher than expected levels of atrazine in urine in the spring 2011 samples taken before any reported pesticide applications
- Whether air is a significant exposure pathway for local residents
- Whether there are higher than expected health issues for local residents that could be attributable to pesticide exposures

PHA Recommendations

Pertaining to the Exposure Investigation underway, OHA recommends that:

- US EPA develop a sampling and analysis plan to for air monitoring
- ODA and ODF continue to provide pesticide application data
- State and federal agencies develop an implementation plan to address recommendations

PHA Recommendations

Pertaining to broader and/or longer-term issues identified by the Exposure Investigation, OHA recommends actions be taken to address:

- Consistent pesticide application record-keeping processes
- The feasibility of implementing a notification system
- State and federal agencies develop an implementation plan to address these recommendations
- Community members consider seeking the assistance of a professional mediation group

Next Steps

OHA will:

- Review and respond to all public comments received, and release a final version of this interim report upon completion.
- Work with state and federal partners, community members, and other stakeholders to implement the recommendations in this report.
- Continue to maintain and provide updates through the Highway 36 web page and listserv.
- Compare application records from 2011 to application records from 2009 and 2010 to determine if there were noticeable (substantial) changes in pesticide application practices after the EI was initiated in 2011.
- Review air sampling data once it is collected by the EPA.
- Develop and release a final Public Health Assessment report which will include all previous sampling data, pesticide application data from 2009-2011 and air sampling data collected by the EPA.

Questions?



We'll take a short break and resume in 15 minutes for a
Question & Answer period.