

## MEETING SUMMARY

### Community Environmental Working Group

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#### *“Striving for Continuous Environmental Improvements at Intel”*

**Date:** May 18, 2016  
**Time:** 5:00–7:00 p.m.  
**Location:** Corrales Senior Center

#### Members Attending

John Bartlit, NM Citizens for Clean Air & Water  
 Mike Williams, NM Citizens for Clean Air & Water

Hugh Church, American Lung Assc. in NM  
 Sarah Chavez, Intel  
 Dennis O’Mara, Corrales resident Corrales Residents for Clean Air and Water

#### Non-Members Attending

Jeff Radford, Corrales resident, *Corrales Comment*  
 Lynne Kinis, Corrales resident, Corrales Residents for Clean Air and Water  
 Carolyn O’Mara, Corrales resident  
 Sue Evatt, Corrales resident

Don Mabry, Corrales resident  
 Jerry Dusseau, Corrales resident  
 Jannie Dusseau, Corrales resident  
 Liz Shipley, Intel  
 Antonio Sanchez, Rio Rancho

#### Facilitator

Shannon Beaucaire, Facilitator

CJ Ondek, Recorder

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#### HANDOUTS

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| ▪ CEWG Draft Agenda, May 18, 2016   | 2016                               |
| ▪ Draft Meeting Summary, April 2016 | ▪ EHS Activity Report              |
| ▪ Action-Item Progress Report, May  | ▪ Steve Dickens Slide Presentation |

#### PROPOSED AGENDA

- |                                                         |                                               |
|---------------------------------------------------------|-----------------------------------------------|
| ▪ Welcome, Introductions, Announcements and Brief Items | ▪ Overview of Corrales Community Health Study |
|                                                         | ▪ Adjourn                                     |

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**WELCOME, INTRODUCTIONS, ANNOUNCEMENTS, AND BRIEF ITEMS**

John Bartlit opened the meeting by referring the CEWG mission, which was to make environmental improvements at Intel, reduce chemical emissions, and improve community dialogue. Introductions were made.

Agenda—Revisions and Approval

No comment.

Meeting Summaries—Revisions and Approval

No comment.

**OVERVIEW OF CORRALES COMMUNITY HEALTH STUDY**

John Bartlit thanked Dennis O'Mara for arranging tonight's presentation by Steve Dickens. Mr. Bartlit read this introduction of Steve Dickens:

From 2000 to 2013 Steve Dickens was the Health and Environment Director at River Network, a national nonprofit conservation organization. Mr. Dickens is author of *Cancer Downstream: A Citizen's Guide to Investigating Pollution/Health Connections*. He is also a licensed psychologist and currently the director of a public nonprofit employee assistance and wellness program. Mr. Dickens has held an appointment as a Visiting Scientist at the Harvard T.H. Chan School of Public Health in the Department of Occupational and Environmental Health for the past decade.

Steve Dickens gave the background of the organization he worked for at the time of the Community Health Study—River Network, which at the time was 20 professionals living across the U.S. who provided watershed groups with technical support around water quality. He also provided the genesis for the research. Cynthia Lopez, a PhD in environmental epidemiology who worked at the University of New Mexico, was Mr. Dickens' working partner and provided consultation to the Corrales Residents for Clean Air and Water (CRCAW). The Southwest Organizing Project (SWOP) also requested assistance around environmental health issues in Corrales, and Mr. Dickens was pulled into the project to assist.

Mr. Dickens began his slide presentation. Please refer to the attached slide presentation for more details on charts and figures.

**Slide 3: Citizen complaints**

- *Respiratory problems*
- *Fainting*
- *Neurological disorders*
- *Rashes*
- *Birth defects*
- *Other reproductive problems*

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- *Seizures*
- *Abnormal irritations of the nose, throat and lungs*
- *Severe headaches*
- *Chronic fatigue*

Mr. Dickens said that shortly after Intel started operations, residents began complaining about noxious odors. Cynthia Lopez began talking to Corrales residents, who provided a litany of health complaints, listed in Slide 3, above. Mr. Dickens said that these were health problems found in any community and meant little by themselves. Rarely was it possible to conduct a scientific study in a community that clearly demonstrates a causal linkage between exposure to a particular source of pollution and health problems. It was more a matter of trying to put together data and information, and then to have citizens and scientists discuss what they could logically conclude from the data. Mr. Dickens said this was the nature of much scientific inquiry. It wasn't unusual to study something for five years and end up with more questions than what one started with. It wasn't always about getting a straight answer, but about getting good information that often led to a partial answer and inevitably more questions. Mr. Dickens said they turned to the field of toxicology to begin to figure out the citizen health complaints.

#### **Slide 4: Toxicology graphic**

#### **Slide 5: Toxic Release Inventory**

**In its 2000 TRI report, Intel reported discharging the following chemicals from their Rio Rancho plant:**

- **Ammonia 4,740 pounds**
- **Chlorine, 4,390 pounds**
- **Ethylene Glycol, 660 pounds**
- **Hydrogen Fluoride, 4,935 pounds**
- **N-Methyl-2-Pyrrolidone, 360 pounds**
- **Nitrate compounds, 82,900 pounds sent to Albuquerque Waste Water Treatment plant**
- **Nitric Acid, 1,825 pounds plus 190 pounds sent to Albuquerque Waste Water Treatment plant**

Mr. Dickens said toxicology looked at whether a particular substance could have an impact on a living being. For this case, they looked at what chemicals were discharged from Intel, and whether they could conceivably cause the reported symptoms. They also asked about the exposure vector—how citizens became exposed to the toxins. To investigate these questions, Mr. Dickens said he looked at the Environmental Protection Agency's (EPA) 2000 Toxic Release Inventory Report. All U.S. corporations were required to report the items they discharged into the air, water and soil, and these were published in the Toxic Release Inventory Report. Intel reported discharging the elements listed in Slide 5. Next Mr. Dickens said he consulted with the

National Library of Medicine online to research the contaminants and ensuing health issues they might cause at low levels of chronic exposure. Citizens in the community would more likely experience low levels rather than high levels of chronic exposure, he said. Mr. Dickens findings are listed next in Slides 6 through 11.

**Slide 6: Known Health Effects (Low Chronic Concentrations) of Ammonia**

- **Eye irritation**
- **Throat irritation**
- **Lung irritation**
- **Skin irritation**

**Slide 7: Known Health Effects (Low Chronic Concentrations) of Chlorine**

- **Eye irritation**
- **Sore throat**
- **Coughing**
- **Skin irritation**

**Slide 8: Known Health Effects (Low Chronic Concentrations) of Ethylene Glycol**

- **Nausea**

**Slide 9: Known Health Effects (Low Chronic Concentrations) of Hydrogen Fluoride Irritation to:**

- **Eyes**
- **Skin**
- **Lungs**

**Slide 10: Known Health Effects (Low Chronic Concentrations) of Nitric Acid**

**Can cause severe:**

- **Eye irritation**
- **Nose irritation**
- **Throat irritation**
- **Lung irritation**

**Slide 11: Symptoms can be a sign of compromised immune system**

- **Frequent headaches**
- **Frequent sore throats**
- **Allergy-like symptoms**

Mr. Dickens commented that all the symptoms mentioned in the last few slides epidemiologists have linked to a compromised immune system.

**Slide 12: Chemicals in Use at Intel**

- **80 chemicals approved for production at Intel**
- **Most are known to be irritants to the eyes, lungs, nose and throat**
- **In higher concentrations can cause reproductive disorders, brain, liver and kidney damage, pulmonary edema, and birth defects.**

Mr. Dickens said they did not research all 80 chemicals emitted by Intel, but the core chemicals reported to be discharged.

**Slide 13: Area Map**

Mr. Dickens said they focused their study at an area in the community that was down slope of Intel—both downwind and down watershed of Intel. This was the area CRCAW requested they study. At the time, community members were most concerned about water contamination.

**Slide 14: Corrales Residents for Clean Air and Water and Southwest Organizing Project**

- **Requested help of River Network**
- **Health Survey**
- **Before we could respond:**
  - **Obtained health survey used by NMHD**
  - **Mailed survey to 2,000 homes in Corrales**
  - **25% responded to original survey**
- **Concern about potential for response bias**

Mr. Dickens said in the beginning Cynthia Lopez was consulting with community members, who were quite excited about the efforts. Fred Marsh, leader of Corrales Residents for Clean Air and Water, went to the New Mexico Department of Health (NMDOH) and procured a health survey to mail to 2,000 Corrales residents. (Mr. Dickens said he was not involved in this effort.) About 25% of community members responded to the survey. Mr. Dickens said the NMDOH health survey mailing occurred right around the time he got involved with the project and created the potential for response bias. Community members would not be happy about having to complete another survey.

Mr. Dickens discussed methodology. In a study of this type, surveys sent to everyone in the community must have some kind of mechanism to ensure they get almost 100% response. That was hard to accomplish. What researchers tend to do instead of surveying the entire community is to take a random sample and ensure they get a high response rate for those people randomly selected. The way they do that is to doggedly chase down everyone who received a survey to complete it.

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**Slide 15: Validation Survey**

- **Randomly selected 60 households**
- **30 close to Intel**
- **30 farther away from Intel**

*Health Problems – for each member of Household (last 3 months)*

Mr. Dickens said he was uncertain about how to proceed with his study now that this other NMDOH survey was released in the community, so brought the issue to an epidemiology Advisory Committee. They suggested that he use the NMDOH data and do a small random survey of about 60 households, which they felt was enough to establish validity. The idea behind this tactic was if in the randomly selected households they saw similar results to the data collected in the original survey, then that would validate the results. On the other hand, if the data were different from the original survey, then that would show that the original survey results were not very valid.

**Slide 16: Primary Indicators of Exposure**

- **Living Close to Intel**
- **Smelling unusual odors**

Mr. Dickens said the two key indicators they looked at when they began to analyze the data was how close someone lived to Intel and whether they reported unusual odors. They also looked at different indicators to see if residents were being exposed by water or air. Contrary to expectations, it did not look like there was any exposure vector from water, so they began to focus on air as a potential source of exposure. Mr. Dickens underscored that what he was saying should not be taken as gospel as they worked from assumptions based on information provided them about source water and other things.

**Slide 17: Hypotheses**

- 1. Some hazardous discharges from Intel carry an odor**
- 2. Smelling odors is related to proximity to Intel**
- 3. Smelling odors is an indicator of exposure**
- 4. Most respondents identify Intel as source of odors**
- 5. Those who smell odors have more adverse health outcomes**

Mr. Dickens said the research team formed several hypotheses to test, listed in Slide 17. Mr. Dickens said they did an extensive analysis of the data, and this presentation included only a small part of it. He said he would be “presenting for a week” if he presented all the data. So this presentation contained the study highlights.

**Slide 18: Allergy-like Symptoms [bar chart]**  
**Residents Smell Unusual Odors**

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### Significance Levels

- **Original Study,  $p < 0.002$**
- **Validation Study  $p < 0.007$**

Mr. Dickens said the bar chart had indicators of whether residents smelled unusual odors. This chart showed that people who smelled unusual odors were more likely to report allergy symptoms.

### Slide 19: Epidemiology graphic

Mr. Dickens said with this analysis the study moved into the realm of epidemiology, which looked at adverse health outcomes in a particular area to see if their number was more than would ordinarily be expected. This study was designed with a built in control, which is common in epidemiology studies. In environmental epidemiology, demographics could strongly affect research. So in this case, to keep demographics similar, they divided the community into two groups: people living closer to Intel and people living farther away from Intel.

### Slide 20: Statistical Power

- **Likelihood of producing statistically significant results**
- **Why study headaches instead of cancer?**

Mr. Dickens said statistical power is the likelihood of being able to detect statistically significant effects if an effect is really there. There were times when a study may not have sufficient statistical power, but an effect may still be present. If there wasn't enough statistical power, the study wouldn't show anything, and people might interpret it that exposure to a substance did not affect health. Rather, the results would mean that we don't know if exposure produces the adverse health outcome. So, it was important to achieve good statistical power.

Mr. Dickens explained why they looked at headaches, sore throats, and coughing versus cancer, birth defects, seizures, or other more significant health problems. The reason, he said, was in a small study such this, the latter occurred in such small numbers that they would not be likely to see statistically significant results even if something was happening—it had little statistical power.

### Slide 21: ATSDR

- **House Subcommittee on Investigations and Oversight**
- **ATSDR testified multiple factors have posed challenges:**
  - **Limitations of science to answer community questions about effect of chemical exposures**
  - **Limitations in ATSDR's ability to collect data related to exposures**

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Mr. Dickens said ATSDR was previously investigated more than once by the Government Accountability Organization (GAO), the U.S. House of Representatives and the U.S. Senate, and accused of wasting the government's money because many of its studies were inconclusive. Congress members were upset because the government was paying millions of dollars to ATSDR to say absolutely nothing. In the committee hearing referenced in Slide 21, ATSDR testified that multiple factors have posed challenges for the agency, including limitations in the ability of available science to answer community questions about the effect of chemical exposures, limitations in ATSDR's ability to collect data related to exposures, and reductions since 2004 in the number of ATSDR staff and resources available to conduct the agency's mission. Mr. Dickens said the ATSDR was addressing the problem he raised in the previous slide, which was the problem of trying to investigate serious health problems in small communities. ATSDR was telling the truth. The science was weak. Mr. Dickens shared a joke in field: An environmental catastrophe is one that is so bad that even an epidemiology study can pick up on it.

#### **Slide 22: Brain Cancer**

- **Normally 1:100,000 chance**
- **As a result of exposure to pollution → 10-fold increase in brain cancers**
- **1:10,000 chance**
- **Population of community is 5,000**
- **Could we tell?**

Mr. Dickens gave an example of how this concept worked. Assume community complained about the incidence of brain cancer. Now assume that the normal odds of getting brain cancer was 1:100,000. Next assume that as a result of exposure to pollution, a community experienced a 10-fold increase in brain cancers. Now the brain cancer rate in this community was a 1:10,000. This increase would be considered huge and cause for serious concern. However, if this community had a population of only 5,000 people, we couldn't possibly see a 10-fold increase. We might see only one person or no one, and neither case would tell us anything. This is the problem of not having enough statistical power, and we rarely have enough statistical power when the background disease rate is low.

#### **Slide 23: Prevalence of Illness**

#### **Slide 24: Prevalence of Illness**

Mr. Dickens said statistical power was why they looked at health problems that were much more frequent, because a higher background rate of illness provides more statistical power.

#### **Slide 25: Statistical Significance**

- < 5% possibility observations due to chance
  - Significant at  $p < 0.05$  level

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- < 1% possibility observations due to chance
  - Significant at  $p < 0.01$  level

Statistics also helped determine the likelihood of something occurring by chance. Mr. Dickens explained the concept of statistical significance. If there is a less than 5% possibility that observations were due to chance, then it's significant at the  $p$  (probability)  $< 0.05$  level. If it's less than a 1% possibility that observations were due to chance, we say it's significant at the  $p$  (probability)  $< 0.01$  level. These were the generally accepted guidelines or conventions for determining statistical significance. If there's a 10% possibility that observations are due to chance, then scientists tend to reject the results as not significant.

#### **Slide 26: Correlation does not imply causation**

- **Storks deliver babies,  $p < 0.0008$**
- **Copenhagen**
  - (after World War II)
- **Migrations from rural areas**
- **Post-war baby boom**
- **As population increased, there was more building construction, which provided more nesting places for storks; hence increasing numbers of storks.**

In Slide 26, Mr. Dickens gave an example of how correlation does not imply causation. Someone found a correlation between the number of storks and newborn babies in Copenhagen in post World War II, and it was highly statistically significant at the .0008 level—in other words, it was not due to chance. This correlation could imply that storks had something to do with new babies being born. But a closer examination showed that people were migrating from rural areas to Copenhagen, and there was a huge post-war baby boom and a building construction boom, which provided more nesting places for storks.

#### **Slide 27: Relationships Found**

- **The next series of slides demonstrate *relationships* not *causation***
- **We are doing health detective work and these relationships, when significant are important evidence to be considered**

Mr. Dickens said the next set of slides were looking for relationships (not causation). Since we we're doing health detective work, these relationships, when significant, were important evidence to be considering in the investigation, but were not determinative of causation.

#### **Slide 28: Frequent headaches**

**Residents Smell Unusual Odors and Live Close to Intel  
Significance Levels**

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- **Original Study**
  - **p<0.006**
- **Validation Study**
  - **p<0.05**

Slides 28 to 44 reviewed the data and findings. Mr. Dickens explained Slide 28 at length, and then moved quickly through the other slides. Slide 28 looked at the relationship between frequent headaches and residents smelling unusual odors and living close to Intel. Mr. Dickens said both of these conditions had to be true to get a “yes” to apply in this case. This was an important way to break down the data, because living next to Intel alone did not necessarily mean higher exposure when it came to airborne pollution, since the area had frequent changeable winds (confirmed by the National Weather Service in Albuquerque). When chemicals were discharged from an industrial plant, they went up into air in a plume and didn’t always come down immediately, although sometimes they did. Also, different chemicals behaved differently and under certain weather conditions. Some chemicals may get transported in the atmosphere before they “fell out” and affected a particular neighbor, which was why proximity to Intel alone was not an ideal indicator. Because both groups in the study did in fact confirm that the smells came from Intel, it seemed to be an indicator that someone reporting unusual odors in air was being impacted. Putting both proximity and smells together was a good indicator of potential exposure to chemicals from Intel.

In this slide, Mr. Dickens explained about 30% in the exposed group reported frequent headaches. In the unexposed group, 10% reported frequent headaches. Next statistics were applied to both the original study and the validation study, and both were found to be statistically significant. So there seemed to be a correlation between frequent headaches, and residents who both smelled unusual odors *and* lived close to Intel. However, just because there’s a relationship did not mean that pollution from Intel caused it. Mr. Dickens said they would discuss that idea later.

Mr. Dickens moved quickly through the next set of slides.

### **Slide 29: Frequent Sore Throats**

#### **Residents Smell Unusual Odors**

**Exposed group: About 24%; Unexposed group: About 12%**

#### **Significance Levels**

- **Original Study**
  - **p<0.007**
- **Validation Study**
  - **p<0.17\***

**\* In validation survey, *proximity to Intel* was related to sore throats at p<0.04**

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**Slide 30: Trouble Sleeping****Residents Live Close to Intel****Exposed group: About 31%; Unexposed group: About 21%****Significance Levels**

- **Original Study**
  - **p<0.008**
- **Validation Study**
  - **Not Significant (NS) (but results in same direction)**

**Slide 31: Intestinal Discomfort****Residents Smelled Unusual Odors****Exposed group: About 23%; Unexposed group: About 12%****Significance Levels**

- **Original Study**
  - **p<0.001**
- **Validation Study**
  - **NS (but results in same direction)**

**Slide 32: Smelled Unusual Odors****Live Close to Intel****Exposed group: About 68%; Unexposed group: About 41%****Significance Levels**

- **Original Study**
  - **p<0.001**
- **Validation Study**
  - **p<0.001**
  
- **68% respondents report Intel as a source of unusual odors**

Mr. Dickens said that the outcome in this slide was expected: People living close to Intel were more likely to smell an unusual odor.

**Slide 33: One or More Adverse Health Outcomes****Residents Smell Unusual Odors****Exposed group: About 78%; Unexposed group: About 59%****Significance Levels**

- **Original Study**
  - **p<0.001**
- **Validation Study**

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- **p<0.001**

**Slide 34: One or more adverse health outcomes.**

**Residents Smell Unusual Odors and Live Close to Intel**

**Exposed group: About 77%; Unexposed group: About 68%**

**Significance Levels**

- **Original Study**
  - **p<0.005**
- **Validation Study**
  - **p<0.001**

**Slide 35: One or more adverse health outcomes.**

**Residents Live Close to Intel**

**Exposed group: About 77%; Unexposed group: About 68%**

**Significance Levels**

- **Original Study**
  - **p<0.025**
- **Validation Study**
  - **p<0.003**

**Slide 36: Two or more adverse health outcomes.**

**Residents Smell Unusual Odors**

**Exposed group: About 77%; Unexposed group: About 68%**

**Significance Levels**

- **Original Study**
  - **p<0.025**
- **Validation Study**
  - **p<0.003**

**Slide 37: Additional Significant Findings from Original Survey Data**

**Based on questions omitted from validation survey**

**(It was necessary to eliminate some questions from the validation survey as a number of new questions were added, and we did not want the survey to be too long)**

Mr. Dickens said that in the next set of slides they had data in the original survey that they didn't use in the validation survey. The validation study had to be shortened due to time. Mr. Dickens and his team conducted the surveys in person, which was time consuming but more reliable than sending surveys by mail. He wanted to show some of these here to give a sense of the results from the original survey.

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**Slide 38: Eye Irritation****Residents Smell Unusual Odors****Exposed group: About 42%; Unexposed group: About 21%****Significance Level**

- $p < 0.001$

**Slide 39: Neurological Problems****Residents Smell Unusual Odors and Live Close to Intel****Exposed group: About 7.5%; Unexposed group: About 3%****Significance Level**

- $p < 0.029$

**Slide 40: Saw Doctor for a Problem Related to Odors****Residents Live Close to Intel****Exposed group: About 7.5%; Unexposed group: About 2.2%****Significance Levels**

- $p < 0.001$

**Slide 41: Health Effects in Pets****Residents Smell Unusual Odors and Live Close to Intel****Exposed group: About 18%; Unexposed group: About 10%****Significance Level**

- $p < 0.039$

**Slide 42: Health Effects in Pets****Residents Smell Unusual Odors****Exposed group: About 18%; Unexposed group: About 10%****Significance Level**

- $p < 0.001$

**Slide 43: Symptoms Decline When Away From Corrales****Live Close to Intel****Exposed group: About 65%; Unexposed group: About 45%****Significance Level**

- $p < 0.001$

**Odds Ratio**

- 2.5

**Slide 44: Anxiety or Depression\***

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**Residents Smell Unusual Odors****Exposed group: About 18%; Unexposed group: About 6%****Significance Level**

- **p<0.02**

**\* This question was added to the validation survey and had not been included in the original survey**

**Slide 45: Trying to assemble evidence for causation**

- **Multiple Logistic Regression**
  - **tease out confounding variables**
  - **ascertain more clearly whether relationships *could be* causal**
- **Develop a model of prediction**

Mr. Dickens said these previous slides were about relationships, next they had to figure out if the relationships meant anything to pay attention to in terms of causation. To look at this they used a statistical procedure called multiple logistic regression. The idea was to tease out confounding factors, which are other factors that could explain the relationship. It was a way to suggest if the relationship raised in the previous slide could express causation or not. They were trying to develop a model that predicted health outcomes. For example, if the health outcome was frequent headaches, they wanted to know, out of the collected data, what best predicted whether or not people had frequent headaches. Some of the questions asked in the survey were: Where do you work? Are you exposed to chemicals at work? Do you smoke? These were questions aimed at assessing other ways people might get exposed to toxins, which could confound the results.

**Slide 46/47: Maps** [fictitious slides]

Mr. Dickens presented fictitious slides (numbers 46 to 48) to further explain confounding factors.

**Slide 48: Regression model** [fictitious slide]

- **% Breathing Problems accounted for by**
  - **Proximity to Intel (e.g., 40%)**
  - **Smoking (e.g., 20%)**

Mr. Dickens said in regression model, we're trying to determine how much each item (each type of exposure) accounts for a problem. In the slide with fictitious information above, were the breathing problems caused by proximity to Intel (40%) or smoking (20%)?

**Slide 49: How models created**

- **Included all exposure variables where there was a significant relationship to adverse health outcome variable at  $p < 0.25$**

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- **Eliminated predictor variables one at a time that were not significant in regression model**
- **Conducted goodness-of-fit test for model**
- **Accepted model if:**
  - **Predictor variables significant at  $p < 0.05$**
  - **95% Confidence Interval for OR did not include 1**
  - **Goodness-of-fit indicated that model accounted for 60-80% of outcome**

Mr. Dickens said they created these models by including all variables where there was a significant relationship to adverse health outcome variables at  $p < 0.25$ . They looked at everything that had a relationship to a health outcome of concern, and then included it into the model to see if it made a difference. They eliminated predictor variables one at a time when not significant in the regression model. They accepted a model if it adhered to the following: Predictor variables significant at  $p < 0.05$ ; 95% Confidence Interval for OR did not include 1; and Goodness-of-fit indicated that the model accounted for 60-80% of the outcome.

#### **Slide 50: Logistics Data**

- **Focused on models where primary bivariate relationship was significant using both original and validation data**
- **Models were built using original data**
- **Validation data had too few observations**

Mr. Dickens said in some instances they found significant relationships between two fields in one study (e.g., original or validation) but not in the other. They decided to exclude all such relationships and include only fields where relationships were significant in both surveys.

#### **Slide 51: ODDS RATIO**

- **The odds of the health problem occurring in exposed group compared to the odds of it occurring in unexposed group**
- **Exposed group: 1:2**
- **Unexposed group: 1:4**
- **Odds Ratio = 2**
- **Double the odds of contracting health problem**
- **Similar to, but different than risk**

Mr. Dickens explained that in the example above, if the odds of the exposed group getting a health outcome is 1:2, and the odds of the unexposed group getting a health outcome is 1:4, then the odds ratio was 2. If you were in the exposed group, you would have double the odds of getting the health problem. Risk, the chances of getting an illness, and an odds ratio are similar if the prevalence of the disease is less than about 10%; if the adverse health outcome is more

common these two concepts diverge. Therefore, Mr. Dickens said, scientists and nonscientists alike had to be mindful about expressing “odds ratio” as it is often confused with risk.

*Note: On the next set of slides, please see the attached slide presentation to review the regression model tables for each symptom presented below.*

**Slide 52: Regression Model—Frequent Allergy Symptoms**

Mr. Dickens said that in looking at all the different fields in this study, they asked which ones best predicted frequent allergy symptoms. The answer, in this case, was these three variables: 1. Gender, 2. Retirement, and 3. Whether a person smelled odors. The first column in the table showed the odds ratio. So, if someone reported smelling unusual odors, the odds of having frequent allergies were almost twice the odds of having frequent allergy symptoms if they did not smell unusual odors. Why did gender and retirement show up as predictors? Mr. Dickens said in epidemiology it was not infrequent to see gender show up as a predictor. In epidemiology studies women often reported adverse health outcomes more frequently than men, simply because it was more of a societal norm for women to be more open than men about health issues. Also, we discussed how people who were retired were possibly more likely to report more frequent allergy symptoms because they tended to be home more and thus exposed more.

**Slide 53: Regression Model— Frequent Headaches**

Mr. Dickens said, in this slide, gender showed up again as a field, as did living close to Intel AND smelling odors. The odds ratio for the latter was close to 2.

**Slide 54: Regression Model— Frequent Sore throats**

Mr. Dickens said a question in the survey was: Do you hang your laundry outdoors? So in this slide about frequent sore throats, laundry showed up as a field, with an odds ratio of 2.1. In pontificating why this may be, Mr. Dickens suggested that in a community with air pollution, the pollution may fall out onto clothes when laundry was hung outdoors. Then, the contaminant particles could be brought into the house and remain on the clothes to become airborne again once the clothes were worn.

**Slide 55: Regression Model—Insomnia**

Mr. Dickens said the fields that showed up with insomnia were: location close to Intel, gender, and whether you had your water tested. They asked the water question because originally the community was concerned about water contamination. The odds ratio for water tested was less than one and was used in the slide to show the unlikelihood that testing one’s water was a predictor of illness. The theory behind this question was that if people had concerns about their drinking water quality they were more likely to have it tested. However, he explained that there could be other interpretations of this as well. He reminded that they were being detectives, and there were multiple ways to interpret things such as this. No one can know absolutely but can only make educated guesses.

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**Slide 56: Regression Model—Persistent Cough**

Mr. Dickens said that living close to Intel AND smelling odors had a higher odds ratio of almost 3, so it was much more predictive of having a persistent cough than smoking (odds ratio 1.8). He emphasized that this was an important finding in terms of what was likely to be causing the persistent coughs that people reported.

**Slide 57: Regression Model—Smell unusual odors**

Mr. Dickens said this slide showed the best thing that predicted smelling unusual odors, which was living in a location close to Intel. With an odds ratio of almost 3, the likelihood was that the unusual odors were coming from Intel. Was it absolutely confirmed? No, but it was likely.

**Slide 58: Regression Model—Dizzy/Disoriented**

Mr. Dickens said people reporting smelling unusual odors, at an odds ratio of 4.1, was the best predictor of whether people reported feeling dizzy or disoriented. This was a strong connection.

**Slide 59: Regression Model—Intestinal Discomfort**

Mr. Dickens said smelling unusual odors was the best predictor of whether people reported intestinal discomfort.

**Slide 60: Regression Model—Irritated Eyes**

Mr. Dickens said smelling unusual odors was the best predictor of whether people reported irritated eyes, with a high 3.0 odds ratio.

**Slide 61: Regression Model—At Least 1 Adverse Health Outcome**

Mr. Dickens said they asked what predicts if a person had at least 1 adverse health outcome. The best predictor they found was whether they smelled an unusual odor (2.5 odds ratio).

With that Mr. Dickens ended his slide presentation and gave the following synopsis. First they looked at toxicology and if Intel could cause the citizen health complaints. The answer was yes, it was plausible. Then they looked at relationships between many different variables and found a lot of highly statistically significant relationships between things like people living close to Intel and having an adverse health outcome, or people smelling unusual odors and having an adverse health outcome. Next they used multiple statistical regression to see if other factors, such as smoking cigarettes, work location, economic status, and many others factors, also predicted these adverse health outcomes, and by and large they did not to the same degree. The variables that clearly predicted health outcomes were living close to Intel, smelling unusual odors or living close to Intel AND smelling usual odors.

Mr. Dickens used the analogy of a detective case. One would try to piece together evidence to figure out what the data meant. As in real life court cases where people were convicted

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incorrectly, it was possible to make similar mistakes in environmental epidemiology. The science was just not perfect. Mr. Dickens went on to answer questions CEWG members sent to him in advance of his presentation.

### Advance Questions and Answers

Question 1: Mathematical analyses normally describe the data set used and the methods of calculation in sufficient detail to allow others to duplicate the results. Is this information available? The data set need not include names or addresses of respondents to the health survey.

- Mr. Dickens answered yes. He pointed out that epidemiological research was different from mathematical analysis, and replicating results was not a matter of simply replicating analysis. Epidemiologists want to replicate the whole study from the beginning to see if they got the same result. Yes, this data was available and belonged to the community; he had an electronic version of the data. He permanently encrypted the data a long time ago using software that no longer existed. He was sure there was a way to un-encrypt it, but it would be complicated. The data may also exist in hard copy, but he would have to check.

Question 2: How are the models used described physically and mathematically? Are the models standard models that are used in such studies? If not, in what way(s) do they differ from those models?

- Mr. Dickens answered that he covered these questions in his presentation, and if people had more questions he would be happy to answer them.

Question 3: What criterion was used to define those living "close to Intel" and those living "farther away from Intel?"

- Mr. Dickens answered that the easy answer was distance. A more complicated answer was that they used a grid provided by the community that divided the community by about 15 quadrants of equal size. Each grid area was labeled, and when they initially analyzed the data they did not know which quadrant people lived in, so as not to bias their findings.

Question 4: The survey results were summarized in the *Corrales Comment* of Nov. 5, 2005, second paragraph, as "people living near (Intel) are more likely than other villagers to have persistent coughs, frequent headaches, sore throats and other allergy-like symptoms." How do the survey statistics compare with statistics and other information available from multiple sources on people who suffer from multiple chemical sensitivity (MCS)? For example,

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Wikipedia asserts "Epidemiological data from three states puts the prevalence of chemical sensitivity at 16 to 33% of the general population" of which only a small fraction is diagnosed.

- Mr. Dickens said he did not know the answer because they did not look at the concept of MCS. Certainly, it could be part of what they were seeing in the research. Individuals with different genetic makeup and can be impacted differently. Some people are more sensitive to chemicals and therefore more impacted than others.

Question 5: When was the original survey conducted and who conducted it?

- Mr. Dickens answered that the original survey was done in 2005.

Question 6: How does the validation survey differ from the original survey and what was the basis for the changes? When was it conducted and by whom?

- Mr. Dickens answered that community volunteers in conjunction with River Network staff conducted the validation study in 2006.

Question 7: Is there a final report or document for this survey?

- Mr. Dickens answered no. They had started writing it and got to about 10 pages, but working for a small nonprofit, there was no funding to finish the report. He had to move on to a different community to begin another project. He apologized for not completing the report, but said someone can still finish writing the report if they wanted to.

### **Audience Questions and Answers**

Question 1: Are other communities with Intel plants experiencing similar kinds of health complaints and concerns as Corrales?

- Steve Dickens said he could not answer the question definitively but to ask SWOP. At the time SWOP worked with a partner organization that worked with Intel plant communities throughout the West. There were problems at many of the plants, but he couldn't say if they were the same problems. In at least one plant in California, the concern was with employees. He tried several times to meet with Intel executives in Rio Rancho to talk about ways to address the issues or problem. He also met someone from Los Alamos Labs who had developed a new procedure to clean chips using supercritical carbon dioxide. The procedure was implemented by IBM's Fishkill plant, which initially found the process to be successful with fewer by products, but for some reason then stopped

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using it. Mr. Dickens said there were people at Intel who were concerned about environmental issues and wanted to make improvements, but he was not able to meet with them.

- Dennis O'Mara commented that he did not know of any efforts to undertake a similar study as Mr. Dickens' in any of the Intel plant communities. In Oregon there was pushback with regards to the permitting process. There was an organization opposing the current permit and asking that it be examined in a judicial review. Also, there have been a substantial number of reports of ALS (Lou Gehrig's disease) in Oregon. ATSDR was asked but had refused to look at this issue, Mr. O'Mara said. Several of the cases were among Intel employees. Mr. O'Mara said that had Intel adopted the SCORE process using supercritical carbon dioxide, it would have substantially reduced the amount of emissions. Intel declined to use this process because they found that it would not give them any advantage. The tools used in SCORE were expensive and not manufactured at this time.
- Steve Dickens said that an IBM plant near him in Vermont had toxic discharge into water exceeding discharge limits set by nearby New York state for the same contaminants at an IBM plant there. Yet when IBM requested a new permit with higher discharge limits, the state allowed them to increase discharge despite considerable opposition from the community. Vermont had strict environmental laws, but large corporations have such a critical role in a community that they may be afforded exceptions. This was sadly all too common.

Question 2: Jeff Radford asked if Mr. Dickens was aware of air dispersion modeling done by Darko Koracin around the same time as his health study.

- Steve Dickens replied that he did not know much specifically about air dispersion modeling. He did know that the community group received a donation to purchase an FTIR machine to analyze smoke stacks emissions. Data were collected using that machine, but he did not know what happened to that data. Jeff Radford replied that this data were part of an EPA funded study from 2000 to 2004 that contracted with an Arizona company who looked at meteorological data and compared it with the time of citizen complaints. The Darko Koracin report said that the meteorological data correlated with resident complaints. Mr. Radford said he would like to see a comparison between the Koracin report and Mr. Dickens' study and asked if Mr. Dickens would be interested in looking at the Koracin report.
- Steve Dickens replied that he thought it was a great idea to compare and would be happy to look at the report. He was unaware that this study was done.

Steve Dickens closed his presentation by saying that if anyone had any questions or if anyone wanted to do anything with the data to let him know. He had about 4 or 5 notebooks with his analysis that he could scan and send to anyone interested. If he could help at all, just let him know.

Shannon Beaucaire thanked Mr. Dickens for his presentation and time.

### **CEWG Discussion**

- Hugh Church said Slide 17, where it said “those who smell odors have more adverse health outcomes” seemed extremely subjective. We discussed it before in this group. To depend on odors to get answers was more readily available and cheap but not a good solution.
- Lynne Kinis said Fred Marsh told them that chemicals with strong odors were not as dangerous as the chemicals that had no odor and stayed close to the ground. People saying they smelled an odor was an indication that something had changed to the negative in the community area, because they associated it with irritated eyes, sore throat, and coughing. The chemical smell was put out there first to look at, even though odorless chemicals may have been affecting us. Mike Williams said both the pollutants odorless and with odors would travel together basically, so it would not make a difference.
- Lynne Kinis asked about the Darko Koracin report timing. Jeff Radford said it was in 2004. Mike Williams said the CEWG had a summary of the Darko report. It would be complimentary to put the two studies [Community Health Survey and Darko report] together—they were different approaches that spread light on the problem.
- Dennis O’Mara said that although the study had a lot of subjectivity—association did not imply causation—it was the first scientific study of any sort that examined the risk of exposure of Intel emissions to community members. At the request of CRCAW, the University of New Mexico Cancer Center about to complete a study of cancer occurring in the 12 Census tracts around Intel. UNM operated an active cancer surveillance system on behalf of NMDOH, and they go to laboratories, physician offices, hospitals, and all places where people were being treated for cancer, to gather information on prevalence. UNM will look at individual Census tracts and the aggregate. The community had commented that there was a lot of cancer around Intel’s plant. Mr. O’Mara said the results would be available soon, and the CEWG may be able to have a presentation in the foreseeable future.
- Jerry Dusseau said Mr. Dickens’ study was about 10 to 12 years old, and in the interim Intel had made some abatement changes. Was anything being done now to see how effective these change were, or were we seeing the same amount of adverse health

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outcomes and odors complaints? John Bartlit said with money, time and interest they could do a similar study now since lots of things had changed: stacks were higher, emissions were reduced, there was back up pollution controls. Jeff Radford said he did not get nearly as many Intel complaint calls anymore.

- Lynne Kinis said prior to the stacks being raised and the dispersion, her community got the brunt of the emissions. A person in her community who had multiple sensitivities would be awakened in the middle of the night not being able to breath and rushed to the hospital many times. She has since passed away, but she was like a barometer to chemical emissions. But more recently the community had noticed a diminishing of chemicals that people were super sensitive to. Ms. Kinis surmised it could be due to a reduction in the amount of chemicals being emitted along with the stacks being raised or people were not as sensitive anymore. On the other hand, another community member asked about pulmonary fibrosis; doctors had asked him if he worked in the mines or near asbestos after examining his lungs, and the only thing he could think of was proximity to Intel. He said he had spent a lot of time outside when he first moved to this community. John Bartlit said NMDOH did a study on pulmonary fibrosis, which the CEWG looked at, and they had Jonathan Samet also review the study and did not find anything conclusive.

## **ADJOURN**

**NEXT MEETING:** June 15, 2016, 5 to 7 pm, Corrales Senior Center.

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