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## EMF and RF Health Assessment and Safety Program (Program 60)

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Program Manager

EI Occupational Safety and Health Conference  
New Orleans, Louisiana  
April 27, 2010

## Electric Power Research Institute



### Generation

Environmental Control  
Fossil Steam Plants  
Combustion Turbines  
Market Analysis  
Renewables  
Hydroelectric  
Distributed Resources



### Nuclear Power

Component  
Reliability & Safety  
Nuclear Operations &  
Asset Management  
Nondestructive  
Evaluation  
Plant Technology



### Power Delivery & Markets

Transmission  
Substations  
Grid Reliability  
Power Markets  
Distribution  
Power Quality  
Energy Utilization



### Environment

Air Quality  
Global Climate  
Change  
**Electric and Magnetic  
Fields (EMF)**  
Occupational  
Health & Safety  
Land & Groundwater  
Water & Ecosystems

## EMF and RF Health Assessment and Safety

### P60A and P60B – EMF Health Assessment

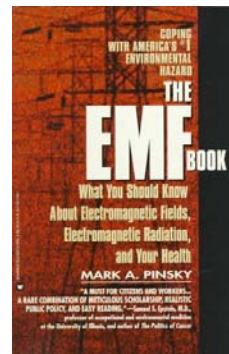
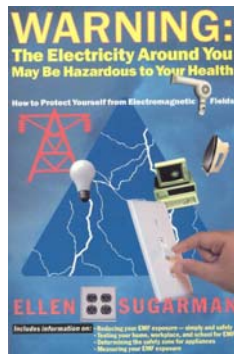
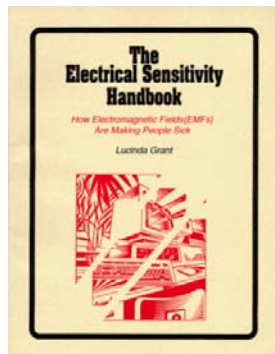
- To address health and safety issues associated with power-frequency environments
  - P60A – Residential
  - P60B – Occupational

### P60C – Radio-Frequency Safety

- To address worker safety issues associated with RF environments and characterize RF exposure levels

## EMF: Are We There Yet?

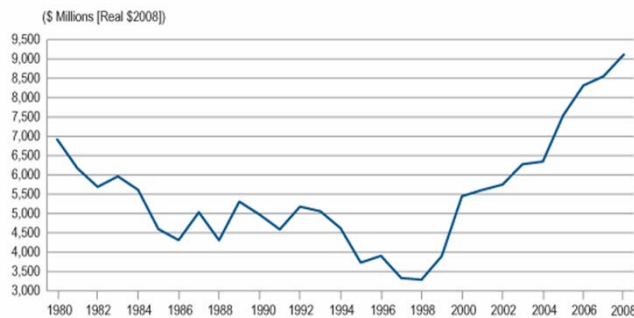
**Short Answer** - Some thought EMF was resolved. But EMF Issue has been **dormant** and has now become very **active**.



## Increasing Investment in T&D Infrastructure

### U.S. 2000-2008

- \$63 billion invested in transmission (figure)
- \$170 billion invested in distribution



Source: EEI

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## Integration of Renewable Resources

Wind Power Grows 39% for the Year



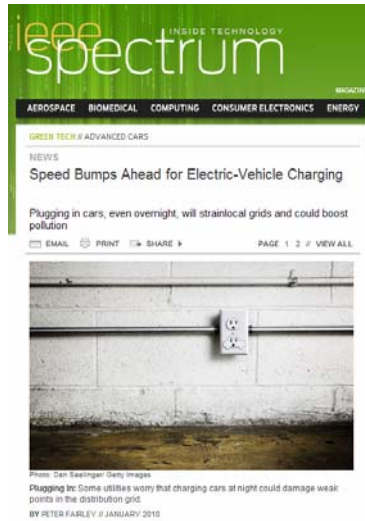
Brian Harkin for The New York Times

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## Electric Vehicle Expansion Worldwide



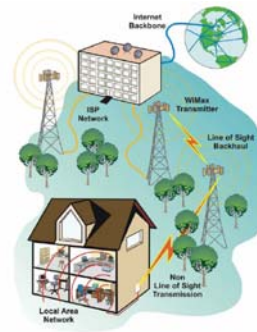
“Some utilities worry that charging cars at night could damage weak points in the distribution grid.”

“...EV charging could black out the neighborhoods of some early EV adopters...”

## Integrations of Smart Grid Technologies

### Increase Efficiency & Reliability

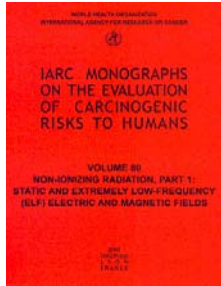
- ~76 million smart meters worldwide 2009
- ~212 million smart meters expected by 2015



## Public Concern about Potential Health Effects

### Scientific Consensus

- 2000 – Childhood leukemia pooled analyses
- 2001 – IARC classifies EMF “Possible Carcinogen”
- 2002 – California EMF Report
- 2007 – WHO Environmental Health Criteria



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## Public Concern about Potential Health Effects

### Popular Media and Activist Organizations

- Do not necessarily mirror scientific consensus
- Do not distinguish between ELF and RF
- Could fuel significant local resistance

The image is a screenshot of a news article from Prevention magazine. The article is titled "Is Dirty Electricity Making You Sick?" and is by Michael Segal. The article discusses the potential health effects of electromagnetic fields (EMF) and radio frequency (RF) radiation. The article is dated Wednesday, February 3, 2010, at 10:12 a.m. The article is part of a "BioInitiative Report" and is available for free. The article is also available in a "FREE 96-page book from PREVENTION!" and is available for purchase. The article is also available in a "FREE Newsletter" and is available for purchase. The article is also available in a "FREE Newsletter" and is available for purchase. The article is also available in a "FREE Newsletter" and is available for purchase.

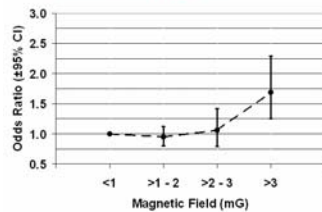
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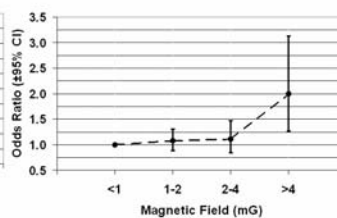
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## Childhood Leukemia – Why The Association?

Greenland et al.,  
*Epidemiology* 2000



Ahlbom et al., *British J. Cancer* 2000



- Cause and effect?
- Chance?
- Other exposure?
- Control selection bias?

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## TransExpo

### International Study of Childhood Leukemia and Residences above Transformer Rooms

- No subject participation required to assess exposure
  - Limit/exclude selection bias
- Focus on highly exposed population
- Funded by EPRI

**Great Potential for Scientific Impact!**



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## UK Study (Draper et al, 2005):

- Is childhood cancer associated with distance from transmission lines?
- Result
  - Leukemia risk versus distance from lines
    - At <200 m, a 69% increase
    - At 200-600 m, a 23% increase
    - However, negligible magnetic field beyond ~150m
- EPRI conducting replication in California

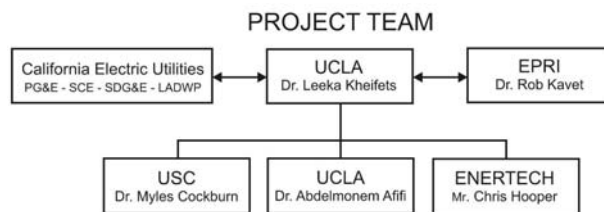


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## Replication of Draper Study in California

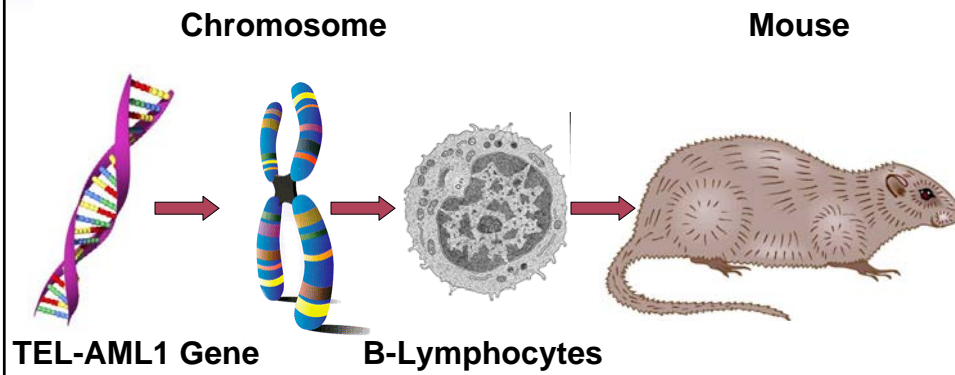


### Record Linkage

- California Cancer Registry
- California Birth Registry
- GIS information of California utilities and addresses of cases and controls

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## Mouse Model of Childhood Leukemia



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## Power Lines and Alzheimer's Disease

American Journal of Epidemiology Advance Access published November 5, 2008

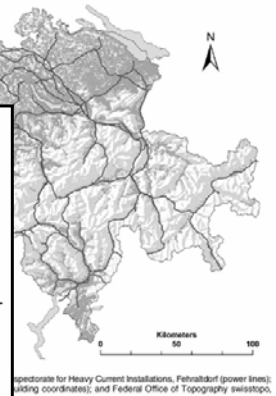
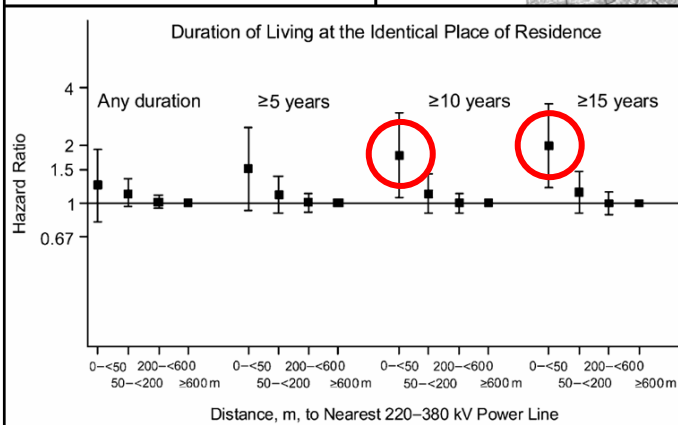


American Journal of Epidemiology  
© The Author 2008. Published by the Johns Hopkins Bloomberg School of Public Health.  
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DOI:10.1093/aje/kwn287

Original Contribution

Residence Near Power Lines and Mortality From Neurodegenerative Diseases: A  
Longitudinal Study of the Swiss Population



coordinates for Heavy Current Installations, Fehrbühel (power lines),  
aiding coordinates), and Federal Office of Topography swisstopo.

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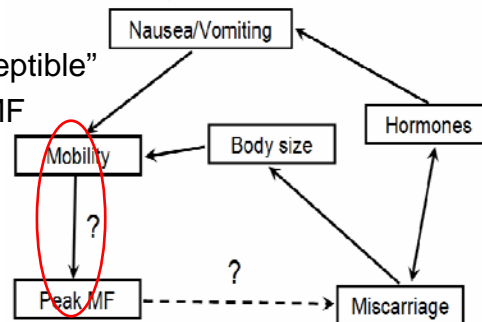
## Miscarriage

### Pre-2002

- Inadequate evidence to link EMF to pregnancy outcomes (NIEHS 1998)
- **Li et al. 2002; Lee et al. 2002**
- Consistently increased risk of miscarriage with peak exposure > 16 mG
  - Higher risk among “susceptible”
- No association with mean MF

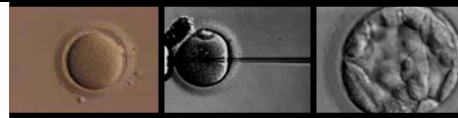
### Savitz 2002

- Mobility hypothesis



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## Miscarriage



### Study of Women with Assisted Reproductive Technologies (ART)

- EPRI to add simultaneous measurements
  - MF exposure (EMDEX)
  - Activity monitor (e.g., accelerometer)



### Main Advantages

- Known date of conception
- Highly motivated women
- “Susceptible” population
- Involvement of couples



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## EPRI Occupational Studies



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## EMF and Animal Behavior

### Bees, Cows...

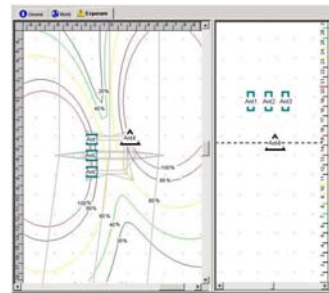
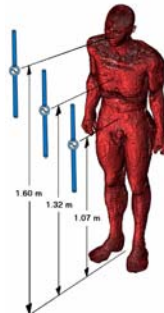
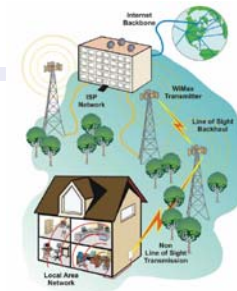


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## RF Safety and Health

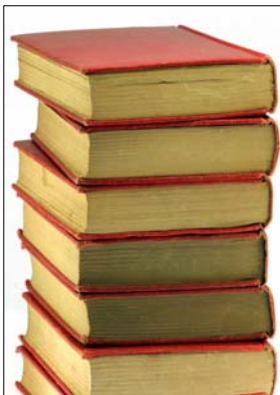


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## EPRI EMF/RF Research Program



### Health Research

- Childhood leukemia
- Miscarriage
- Neurodegenerative diseases (Lou Gehrig's, Alzheimer's)

### Occupational Exposure Studies

### Animal Behavior Studies

### Exposure Assessment

- ELF (e.g., EV) and RF (e.g., AMI)

### RF Safety and Health

### EMF Instrumentation and Software

- EMF Workstation

### Communications

- Scientific community, member companies, public

Leading multi-disciplinary EMF research program internationally

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## EPRI Membership: Is it Worth it?



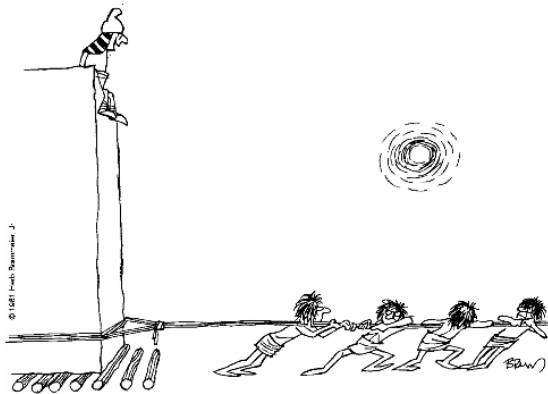
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## Value to Ratepayer and the Public

### Assume a Leadership Role



"Believe me, fellows, everyone from the Pharaoh on down is an equally valued member of the team."

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## Assume Responsibility to Address Important Issue

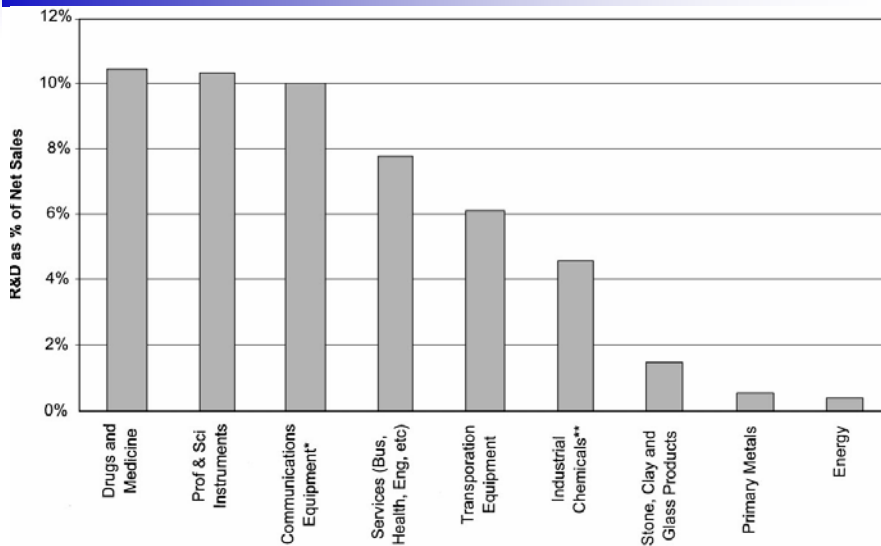


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## Research Funding by Energy Companies (US 2007)



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## Value to Ratepayer and the Public

Address Public Concerns in Cost Effective Manner



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## Potential Avoided Costs

Increased Construction Cost  
(Routing or Underground)

Siting Delays

Lost of Goodwill with the Public

Litigation



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## EPRI Membership Cost

One 500 kV Tower: ~\$150,000+



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## Upcoming Events

### **EMF Scientific Advisory Committee Meeting**

- August 16-17, 2010, New York City
- Hosted by Consolidated Edison, Inc. – Thank you!

### **EMF-RF Area Council Meeting**

- September 28-29, 2010, San Antonio, Texas

### **EI-EPRI EMF Seminar**

- November 4-5, 2010, Washington, DC

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**Thank you!**

**Contact Information**

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