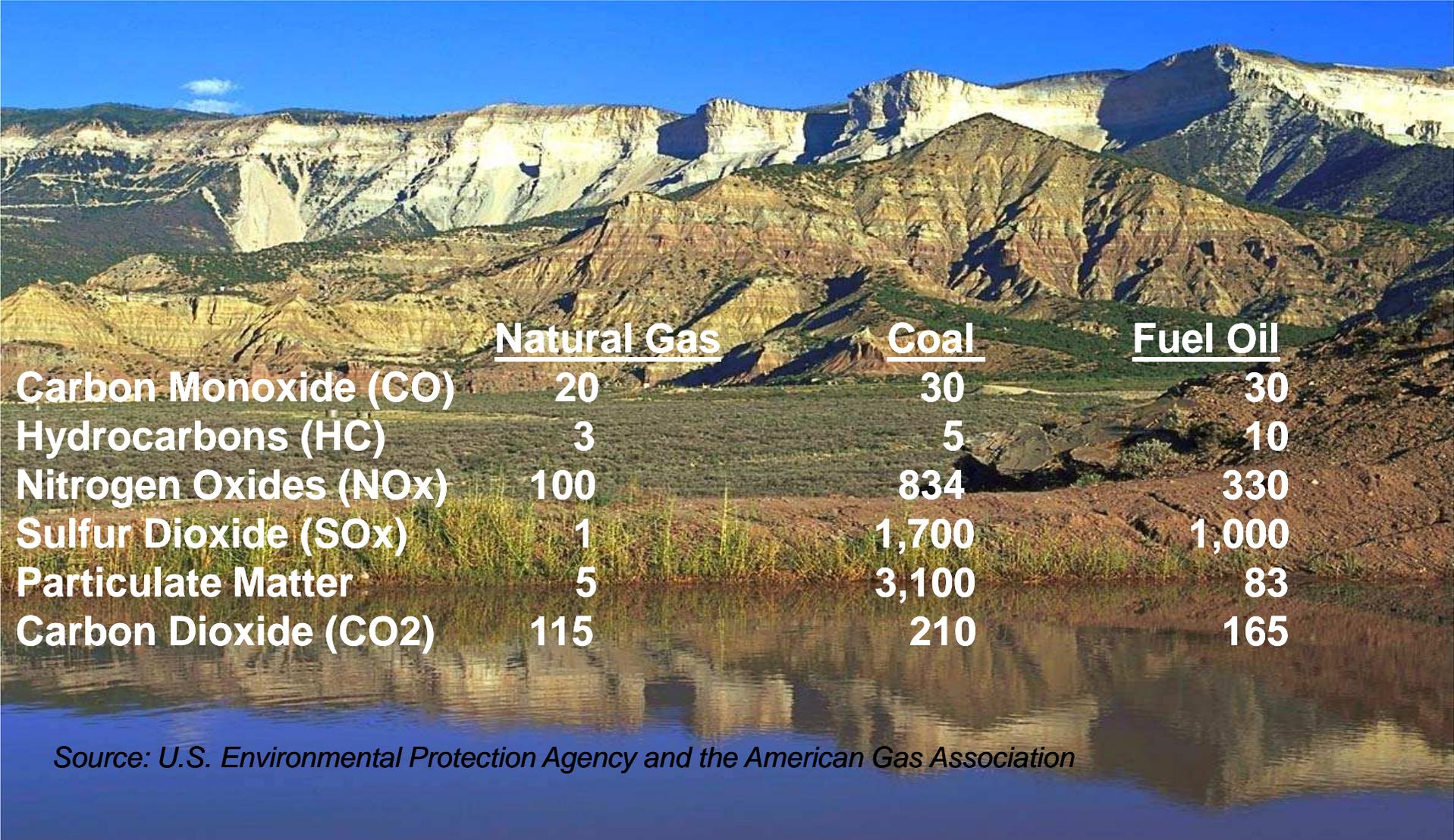


# **Air Quality Basics**

Rick Matar – WILLIAMS PRODUCTION  
February 2010

# Comparison of Air Pollution Emissions of Standard Fuels

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	<u>Natural Gas</u>	<u>Coal</u>	<u>Fuel Oil</u>
Carbon Monoxide (CO)	20	30	30
Hydrocarbons (HC)	3	5	10
Nitrogen Oxides (NOx)	100	834	330
Sulfur Dioxide (SOx)	1	1,700	1,000
Particulate Matter	5	3,100	83
Carbon Dioxide (CO2)	115	210	165

*Source: U.S. Environmental Protection Agency and the American Gas Association*

# Comparison of a Natural Gas Well To Other Energy Sources

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## Natural Gas Well:

- One average natural gas well (1 BCF over 20 yrs, 73 MMCF/yr) creates an initial surface disturbance of approximately 2 acres (even less per well when using directional technology). Once drilled, the majority of land is reclaimed leaving approximately a 40' x 40' square for operations (0.2 acre).

***One Natural gas well can heat over 850 homes for 20 years***

# Comparison of a Natural Gas Well To Other Energy Sources

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## Wind:

- Nearly 20 one MW wind turbines are needed which occupy over 200 acres. Almost **15,000** wind turbines encompassing > 150,000 acres would be required to produce the same amount of energy as a 750-well production area.

## Solar:

- 46 acres of the most efficient commercially available array of solar panels operating for 20 years. Over **34,000** acres of solar panels would be required to produce the same amount of energy as a 750-well production area.

# Comparison of a Natural Gas Well To Other Energy Sources

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## Wood:

- Approximately 44,232 pine trees; that's 402 acres of 1-foot diameter, 100-foot tall pine trees on 20-foot centers. Nearly 300,000 acres of trees would be required to produce the same amount of energy as a 750-well production area.

## Water/Hydro:

- Lake Powell (Glen Canyon Dam) produces electricity equivalent to one of our three Piceance Basin gas fields (267 one-BCF wells).

# Comparison of Gas well disturbance to the disturbance of a Wind Farm

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One Pad with approximately 8 Gas wells North of I-70 in the Parachute area.

Approximately 160 wind turbines In California outside of Palm Springs



# Sources of Air Pollution / Emissions

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## NATURAL

1. **Volcanoes**
2. **Forest Fires**
3. **Decaying Plants**
4. **Pine Forests**
5. **Naturally Occurring Substances Like Radon**

# Sources of Air Pollution / Emissions

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## MAN MADE

- 1. Routine Emissions From Industrial Sources (Power Plants, Refineries, Chemical Plants, Gas Plants, etc.)**
- 2. Mobile Sources Such as cars, trucks, planes, trains, and construction equipment (contributes about 50% of all pollution)**
- 3. Accidental Releases (Spills)**
- 4. Tobacco Smoke**
- 5. Manufacturing, Consumer Products, Diesel Exhaust**
- 6. Man Made Chemicals: Pesticides, Herbicides, Household cleaners**

# Sources of Air Pollution / Emissions

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## Study Links Asia to Smog in North America

- Ozone from South East Asia contributes to American Western States background levels by as much as 30%.

[http://trib.com/news/state-and-regional/article\\_1e6b862f-e2df-5d51-bdde-718ed8edeabbf.html](http://trib.com/news/state-and-regional/article_1e6b862f-e2df-5d51-bdde-718ed8edeabbf.html)

# Air Emissions From Oil & Gas Industry

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## □ Categories and Pollutants

- ▣ Combustion – NO<sub>x</sub>, CO, VOC, SO<sub>2</sub>, Formaldehyde
- ▣ Tank Emissions/Flashing – VOC, Benzene
- ▣ Fugitive – PM<sub>10</sub>, VOC



# Oil & Gas and Drilling

## Air Pollution Reduction Strategies

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- 1. Using High Efficiency Drill Rigs Reducing Overall Drilling Foot Print and Impact on Environment**
- 2. Employing Green Completion Where Feasible**
- 3. Building Centralized Production Facilities Achieving Higher Efficiency for Controls and Reducing Truck Traffic thus Reducing Diesel Exhaust and Fine Particulate Emissions**
- 4. Reclaiming and Recycling Produced Water Through the use of High Efficiency Oil Separation, Polishing and Aerobic Bio-Treatments in Addition to Conventional Controls.**

# Oil & Gas Air Pollution Control Techniques

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- Catalytic Converters
- Condensers
- Flares
- Thermal Oxidizers
- Vapor Recovery
- Water
- Flow back Skids –  
Green Completions



# Legislation Protection Air Quality

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**Clean Air Act -  
Environmental  
Protection Agency  
Regulations & Rules**



**Colorado Department  
of Public Health and  
Environment – Air  
Pollution Control  
Division Regulations**

# Colorado Oil & Gas Conservation Commission - COGCC

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- **Condensate, Crude Oil, Produced Water Tanks**
  - 5 TPY threshold
  - ½ mile from residence etc.
  - 95% VOC control
- **Glycol Dehydrators**
  - 5 TPY threshold
  - ½ from residence, etc
  - 90% VOC control for glycol dehydrators
- **Pits**
  - 2 TPY threshold
  - May not be located within ½ mile of residence, etc.

# Permitting & Compliance with the Regulations

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- ❑ Obtaining permits where required prior to construction/installation
- ❑ Periodic Stack Testing, Sampling and Monitoring
- ❑ Routine Compliance Certifications and Reports to the Overseeing Agencies
- ❑ Routine Agency Audits & Inspections
- ❑ Ongoing Internal Compliance Review and Corrective Action Programs
- ❑ Being an Environmentally Responsible Corporate Citizen

# Local Air Quality Data – 2009 Snap Shot

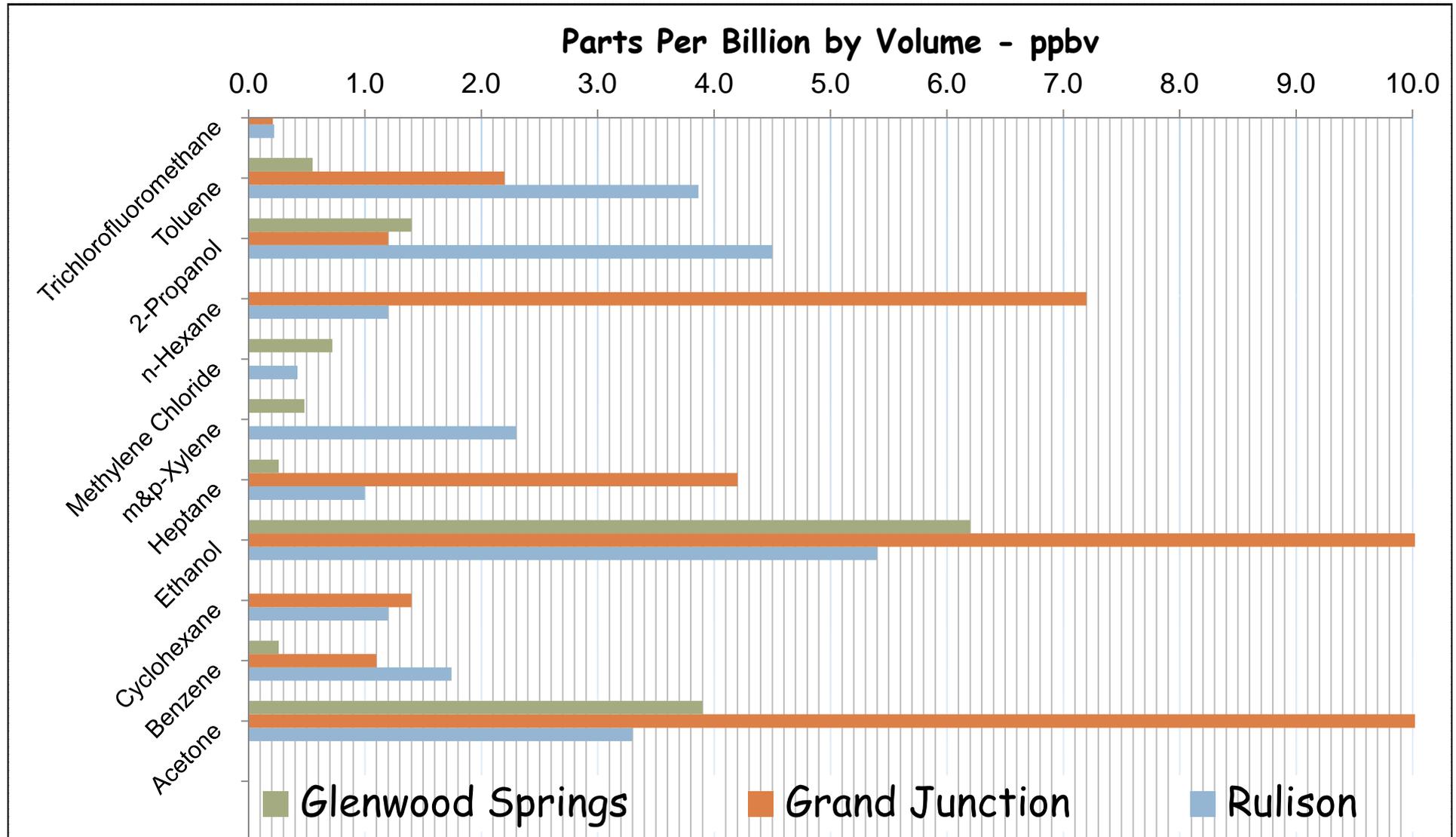
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## Parts Per Billion by Volume - ppbv

Detected Organics	Rulison	Grand Junction	Glenwood Springs	OSHA PEL TWA
Acetone	3.3	23	3.9	1,000,000
Benzene	1.7	1.1	0.26	1,000
Cyclohexane	1.2	1.4	ND	300,000
Ethanol	5.4	18	6.2	1,000,000
Heptane	1.0	4.2	0.26	500,000
m&p-Xylene	2.3	ND	0.48	100,000
Methylene Chloride	0.4	ND	0.72	25,000
n-Hexane	1.2	7.2	ND	500,000
2-Propanol	4.5	1.2	1.4	400,000
Toluene	3.9	2.2	0.55	200,000
Trichlorofluoromethane	0.2	0.21	0.21	1,000,000

# Local Air Quality Data – 2009 Snap Shot

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# EPA Recommended Actions an Individual Can Take to Minimize Exposure to Air Pollution

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## **At home or work:**

- ❑ Conserve electricity to help reduce air pollution caused by power plants.
- ❑ Participate in your local utility's energy conservation programs.
- ❑ Look for the Energy Star label when buying home and office equipment.

# EPA Recommended Actions an Individual Can Take to Minimize Exposure to Air Pollution

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## At home or work - Continued:

- ❑ Avoid smoking indoors.
- ❑ Use gas logs instead of wood. If you use a wood-burning stove or fireplace insert, make sure it meets EPA design specifications. Burn only dry, seasoned wood.
- ❑ Have your home tested for radon and fixed, if high levels are indicated.
- ❑ Avoid excess use of pesticides and follow the manufacturer's directions for application and disposal.
- ❑ Minimize use of household cleaning products and follow use and disposal directions.

# EPA Recommended Actions an Individual Can Take to Minimize Exposure to Air Pollution

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## **At home or work - Continued:**

- ❑ Keep containers of home, workshop and garden chemicals tightly sealed; dispose of empty or outdated products properly.
- ❑ Use paints with lower volatile organic compounds (VOC) content.
- ❑ Use products that emit fewer toxic chemicals, such as wood products with less formaldehyde.
- ❑ If your home was built before 1979, have the paint tested for lead.
- ❑ If your home is over 20 years old, have it checked for asbestos and have any asbestos removed by certified technicians.

# EPA Recommended Actions an Individual Can Take to Minimize Exposure to Air Pollution

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## In your car:

- ❑ Avoid smoking in your car
- ❑ Buy a fuel-efficient car.
- ❑ Combine errands to drive as few miles as possible; car pool, use public transportation, bike, or walk.
- ❑ Accelerate gradually and avoid sharp braking.
- ❑ Keep your vehicle properly tuned.

# EPA Recommended Actions an Individual Can Take to Minimize Exposure to Air Pollution

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**Learn about the products you use in and around your home. Reduce the use of those with toxic substances or better yet, replace them with nontoxic substitutes.**

- ▣ Using baking soda and vinegar in place of more hazardous household cleaners.**
- ▣ Replace a traditional solvent degreaser with a water-based degreaser.**
- ▣ Use a semi-permanent hair color rather than permanent.**
- ▣ Use low or no formaldehyde pressed-wood products.**
- ▣ Remove items that attract pests around your home to reduce the use of pesticides.**

# EPA Recommended Actions an Individual Can Take to Minimize Exposure to Air Pollution

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- ❑ **Pull those weeds! Reduce the amount of herbicides you use.**
- ❑ **Choose pump spray containers instead of aerosols. Pressurized aerosol products often produce a finer mist that is more easily inhaled. Aerosols also put unnecessary volatile organic chemicals into your indoor air when you use them.**
- ❑ **Ask for unbleached paper products or products bleached with hydrogen peroxide or oxygen, which produce less pollution during papermaking.**
- ❑ **Purchase a mercury-free fever thermometer (but don't just throw away your old one that contains mercury).**

# Questions - Consultations

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