



# Contaminación de Aire y Ruido

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# RESUMEN

- Metodos de Monitoréo



- Reglas



- Emisiones

- Polvo ( $PM_{10}$  –  $PM_{2.5}$ )
- Gases
- Ruido



- Estrategia de Muestréo



# Metodos de Monitoréo



# ESTACION DE MONITOREO INALAMBRICA

- Bajo costo
- Con celdas solares
- Opera 24 horas/día
- Instalación Facil
- Capacidad Remota







SOLAR PANELS

LUZ



POLVO

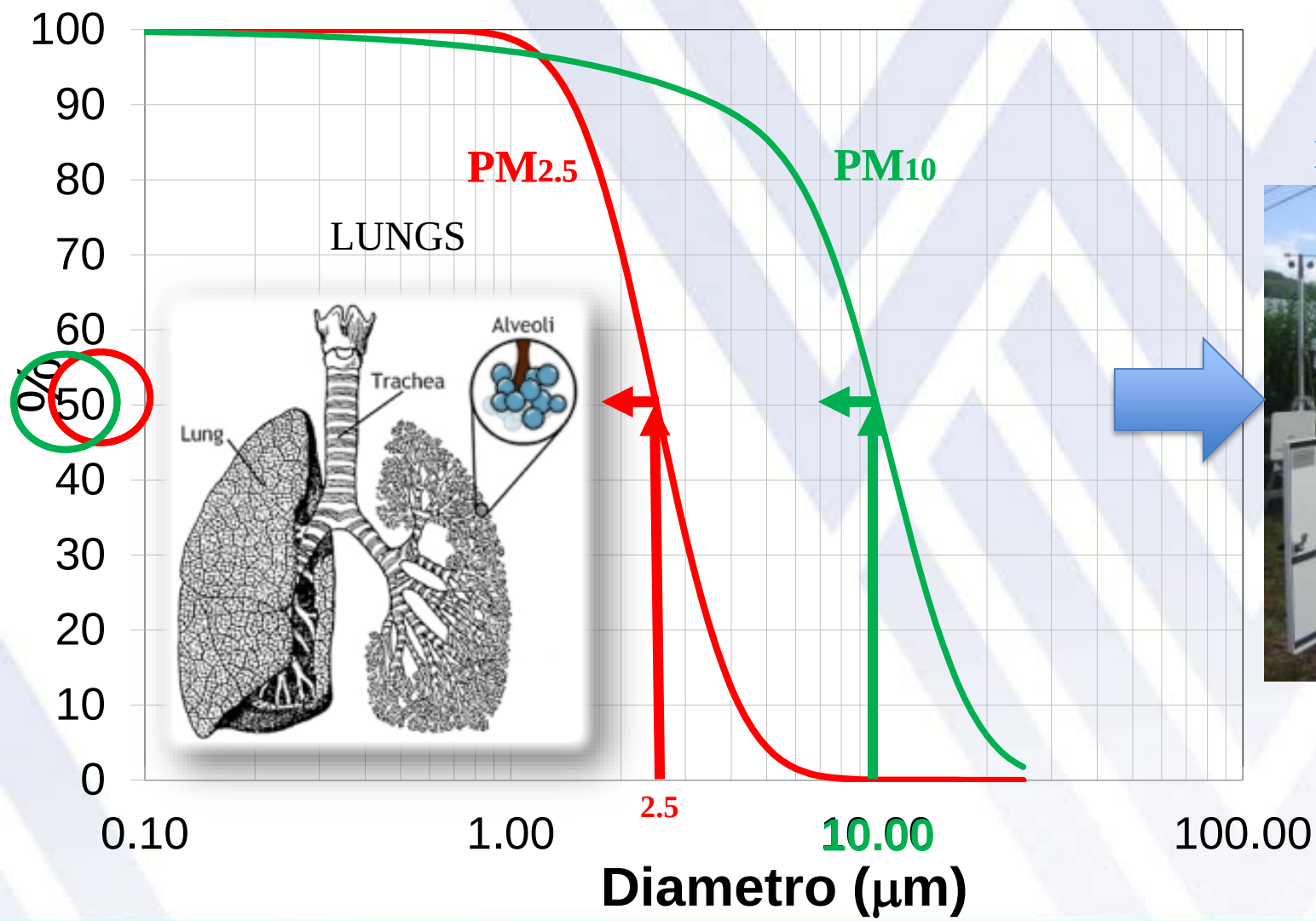


HIDROCARBUROS



RUIDO





Muestreo de Aire



# Reglas



# WHO Air Quality Guidelines Value

| Pollutant                               | Averaging time                                 | AQG value                    |
|-----------------------------------------|------------------------------------------------|------------------------------|
| <b>Particulate matter<br/>PM2.5</b>     | 1 year                                         | 10 $\mu\text{g}/\text{m}^3$  |
|                                         | 24 hour(99 <sup>th</sup> percentile)           | 25 $\mu\text{g}/\text{m}^3$  |
| <b>PM10</b>                             | 1 year                                         | 20 $\mu\text{g}/\text{m}^3$  |
|                                         | 24 hour(99 <sup>th</sup> percentile)           | 50 $\mu\text{g}/\text{m}^3$  |
| <b>Ozone, O<sub>3</sub></b>             | Ozone, O <sub>3</sub><br>8 hour, daily maximum | 100 $\mu\text{g}/\text{m}^3$ |
| <b>Nitrogen dioxide, NO<sub>2</sub></b> | 1 year                                         | 40 $\mu\text{g}/\text{m}^3$  |
|                                         | 1 hour                                         | 200 $\mu\text{g}/\text{m}^3$ |
| <b>Sulfur dioxide, SO<sub>2</sub></b>   | 24 hour                                        | 20 $\mu\text{g}/\text{m}^3$  |
|                                         | 10 minute                                      | 500 $\mu\text{g}/\text{m}^3$ |

Source: WHO, 2005. WHO air quality guidelines global update 2005, WHOLIS number E87950.





# USEPA

## Estándar Nacional de Calidad de Aire

| Pollutant                              | Primary/<br>Secondary    | Averaging<br>Time             | Level                  | Form                                                                                    |
|----------------------------------------|--------------------------|-------------------------------|------------------------|-----------------------------------------------------------------------------------------|
| <a href="#">Carbon Monoxide</a>        | primary                  | 8-hour<br>1-hour              | 9 ppm<br>35 ppm        | Not to be exceeded more than once per year                                              |
| <a href="#">Lead</a>                   | primary and<br>secondary | Rolling 3<br>month<br>average | 0.15 µg/m <sup>3</sup> | Not to be exceeded                                                                      |
| <a href="#">Nitrogen Dioxide</a>       | primary                  | 1-hour                        | 100 ppb                | 98th percentile, <b>averaged over 3 years</b>                                           |
|                                        | primary and<br>secondary | Annual                        | 53 ppb                 | Annual Mean                                                                             |
| <a href="#">Ozone</a>                  | primary and<br>secondary | 8-hour                        | 0.075 ppm              | Annual fourth-highest daily maximum 8-hr<br>concentration, <b>averaged over 3 years</b> |
| <a href="#">Particle<br/>Pollution</a> | primary                  | Annual                        | 12 µg/m <sup>3</sup>   | annual mean, <b>averaged over 3 years</b>                                               |
|                                        | secondary                | Annual                        | 15 µg/m <sup>3</sup>   | annual mean, <b>averaged over 3 years</b>                                               |
|                                        | primary and<br>secondary | 24-hour                       | 35 µg/m <sup>3</sup>   | 98th percentile, <b>averaged over 3 years</b>                                           |
|                                        | primary and<br>secondary | 24-hour                       | 150 µg/m <sup>3</sup>  | Not to be exceeded more than once per year on<br>average <b>over 3 years</b>            |
| <a href="#">Sulfur Dioxide</a>         | primary                  | 1-hour                        | 75 ppb                 | 99th percentile of 1-hour daily maximum<br>concentrations, <b>averaged over 3 years</b> |
|                                        | secondary                | 3-hour                        | 0.5 ppm                | Not to be exceeded more than once per year                                              |

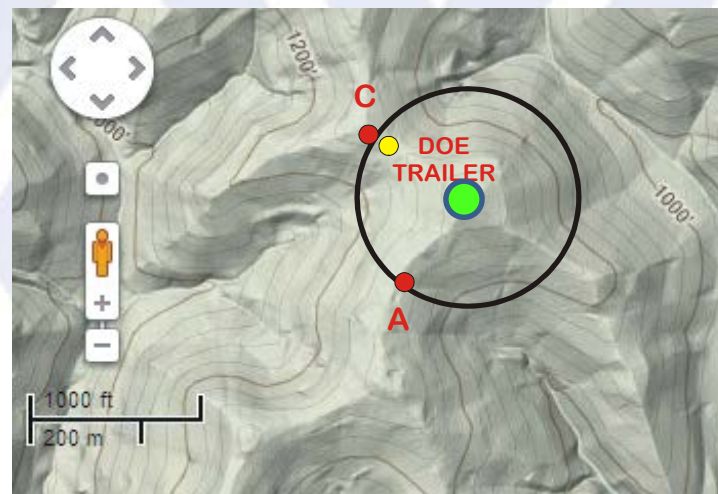
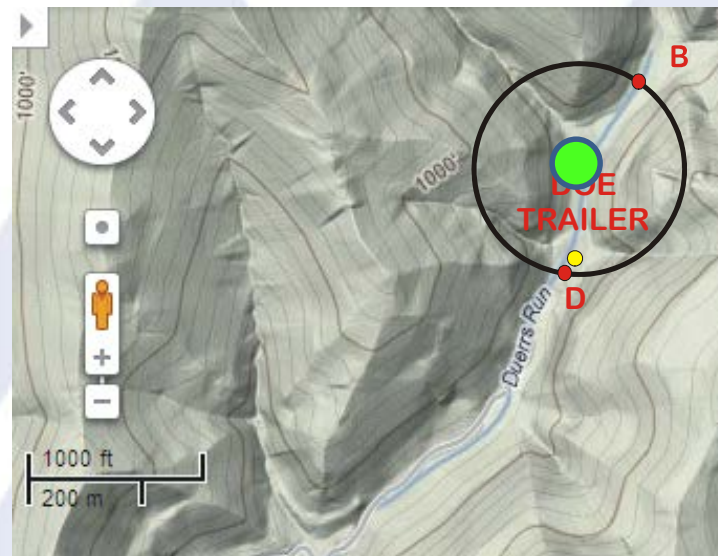


# Emisiones





Meteorología



Topografía



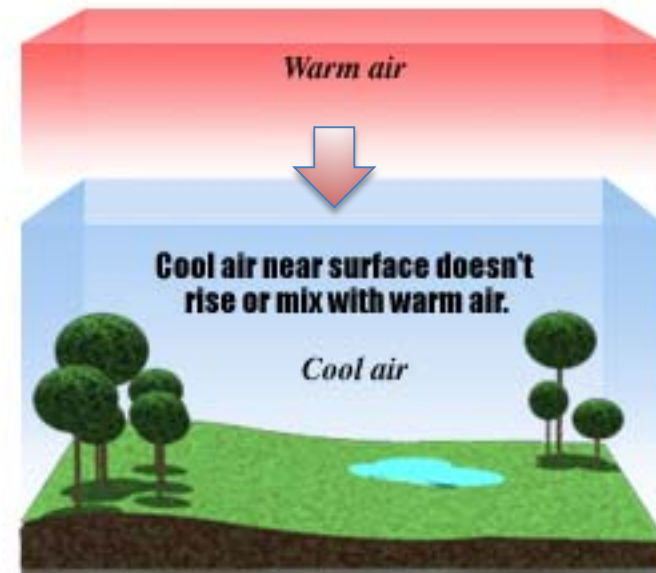
# How atmosphere becomes stable or unstable

## Unstable



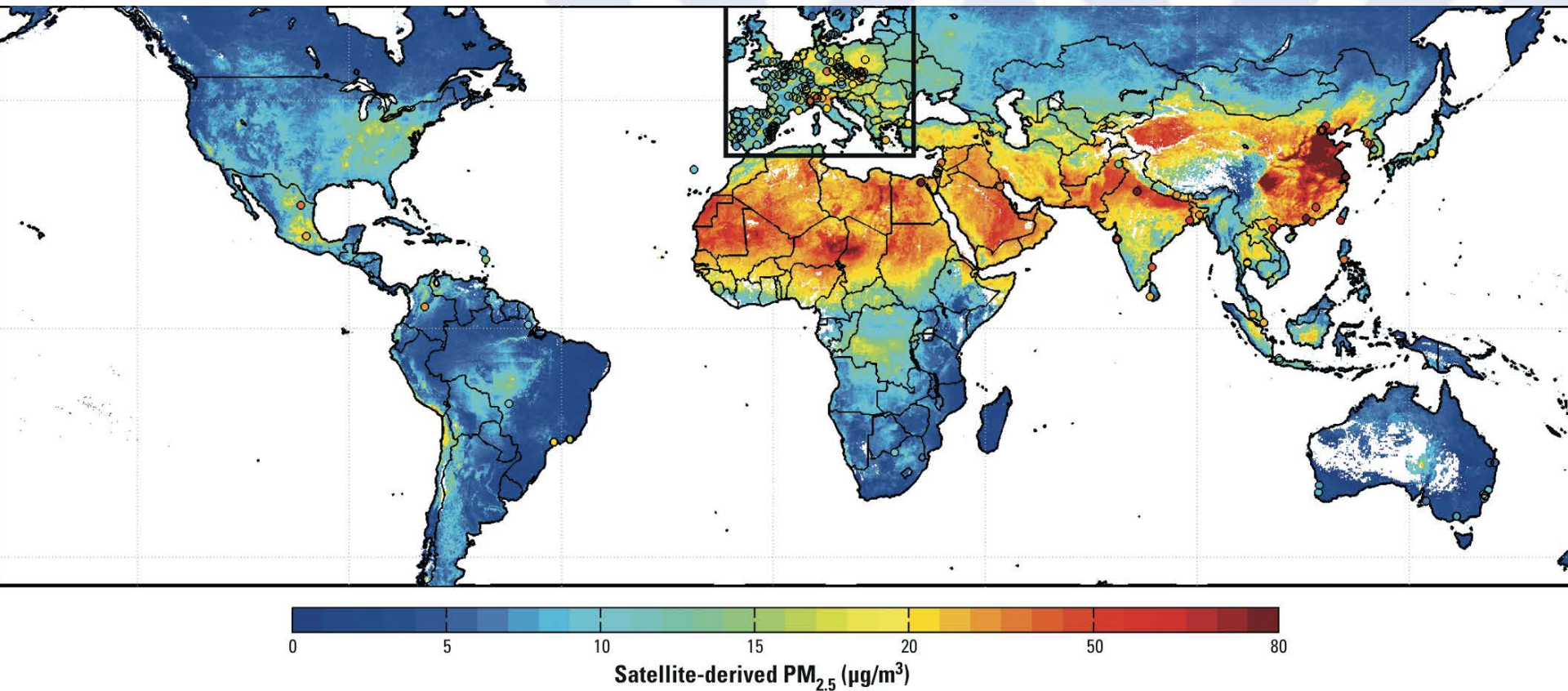
## Stable

## INVERSION





# PM<sub>2.5</sub> Global Annual



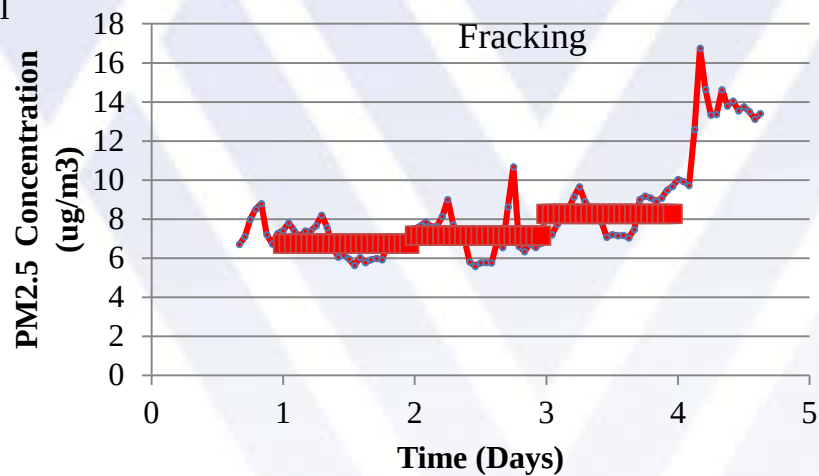
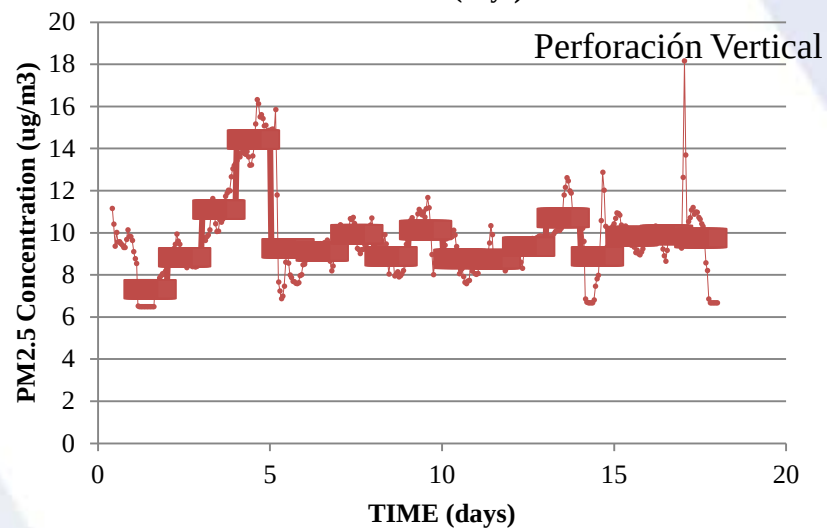
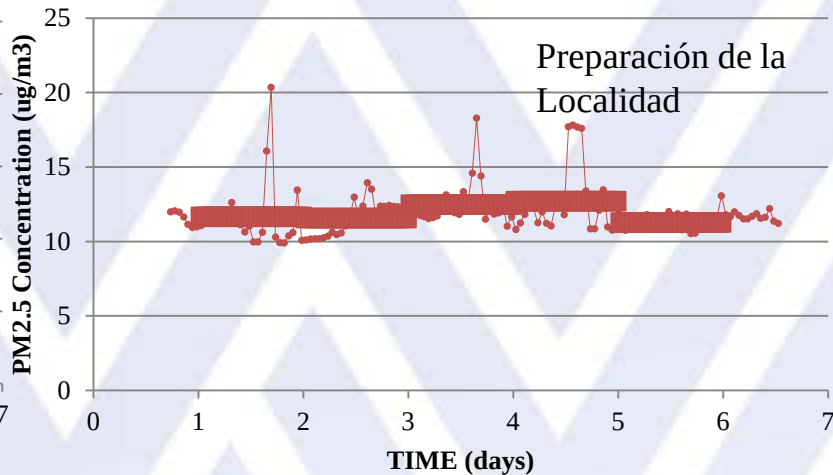
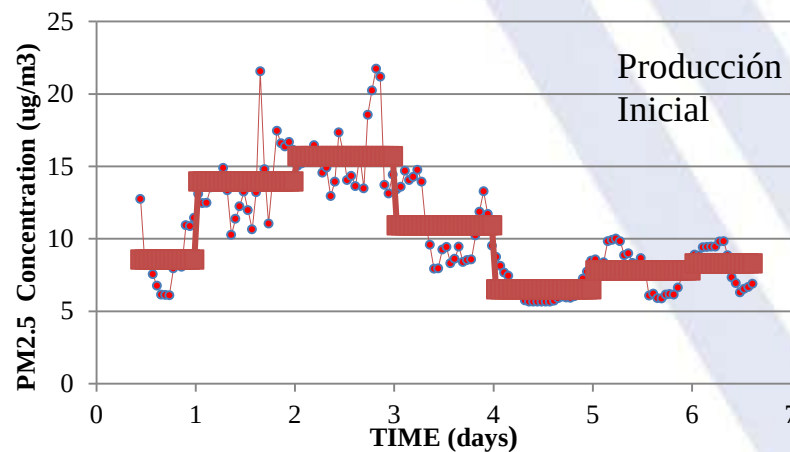
Source: *Environ Health Perspect* 118:847-855 (2010).



# Summary of PM10 and PM2.5 24 Hour Averages Measured by TEOM

|                                      | <u>PM10 (<math>\mu\text{g}/\text{m}^3</math>)</u> | <u>PM2.5 (<math>\mu\text{g}/\text{m}^3</math>)</u> |
|--------------------------------------|---------------------------------------------------|----------------------------------------------------|
| <b><u>NAAQS 24 Hour Standard</u></b> | <b><u>150</u></b>                                 | <b><u>35</u></b>                                   |
| Hydraulic Fracturing/Flowback1       | 12-29                                             | 6-15                                               |
| Flowback                             | 9-32                                              | 5-20                                               |
| Vertical Drill1                      | 9-54                                              | 6-17                                               |
| Hydraulic Fracturing/Flowback2       | 9-90                                              | 5-24                                               |
| Vertical Drill2                      | 5-24                                              | 3-13                                               |
| Horizontal Drill                     | 2-50                                              | 1-13                                               |

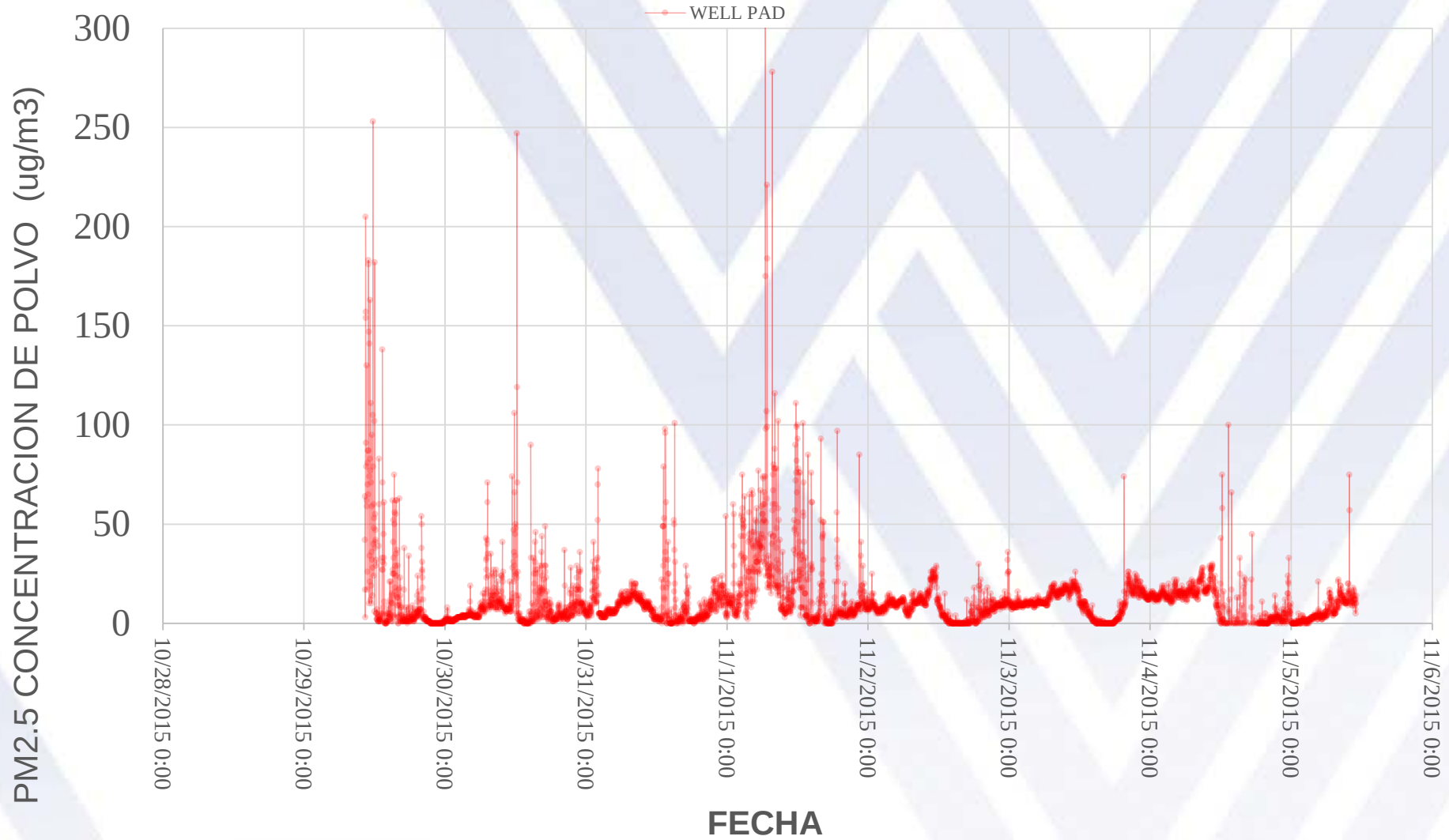




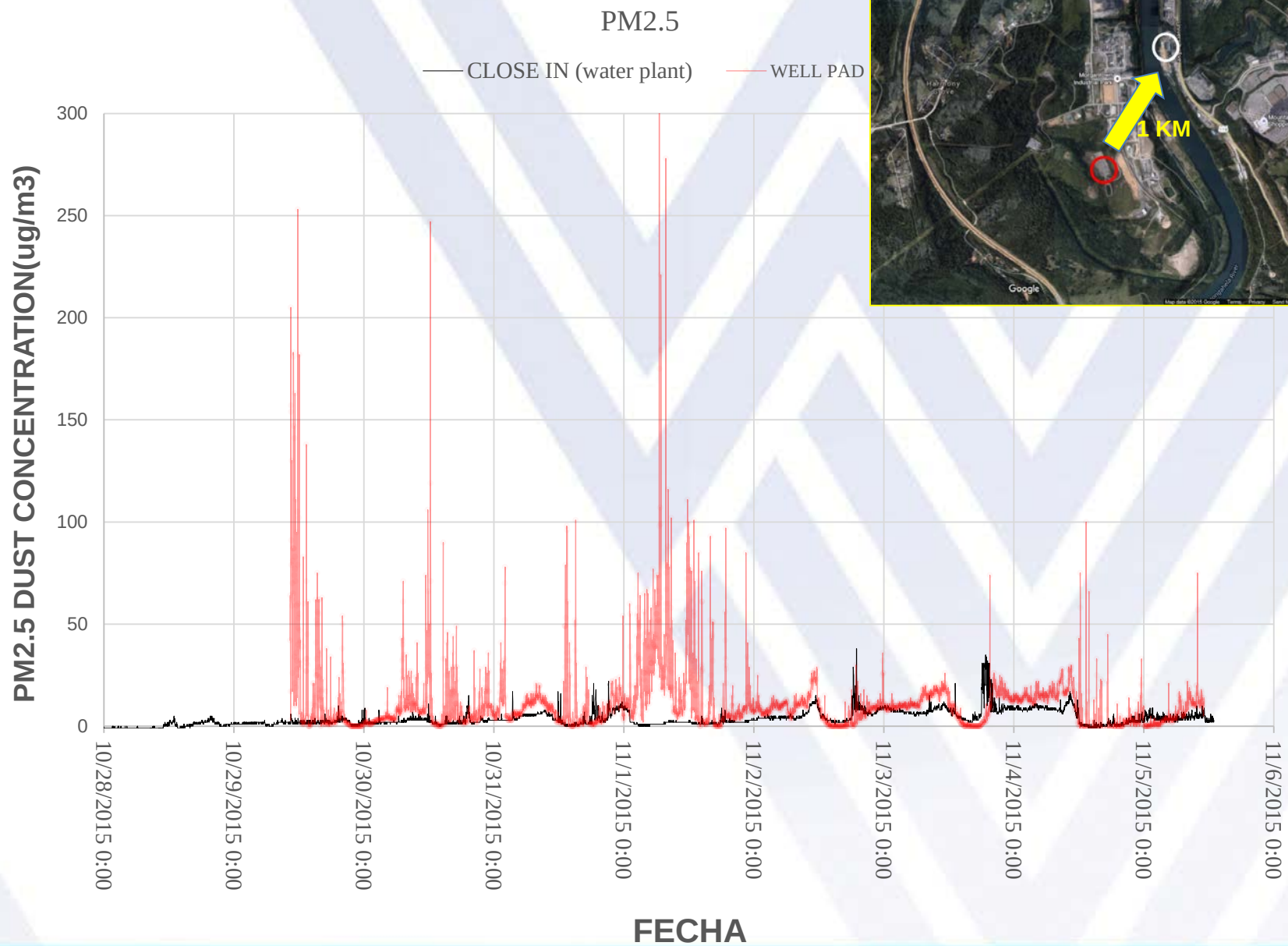
PM<sub>2.5</sub>



# PM2.5





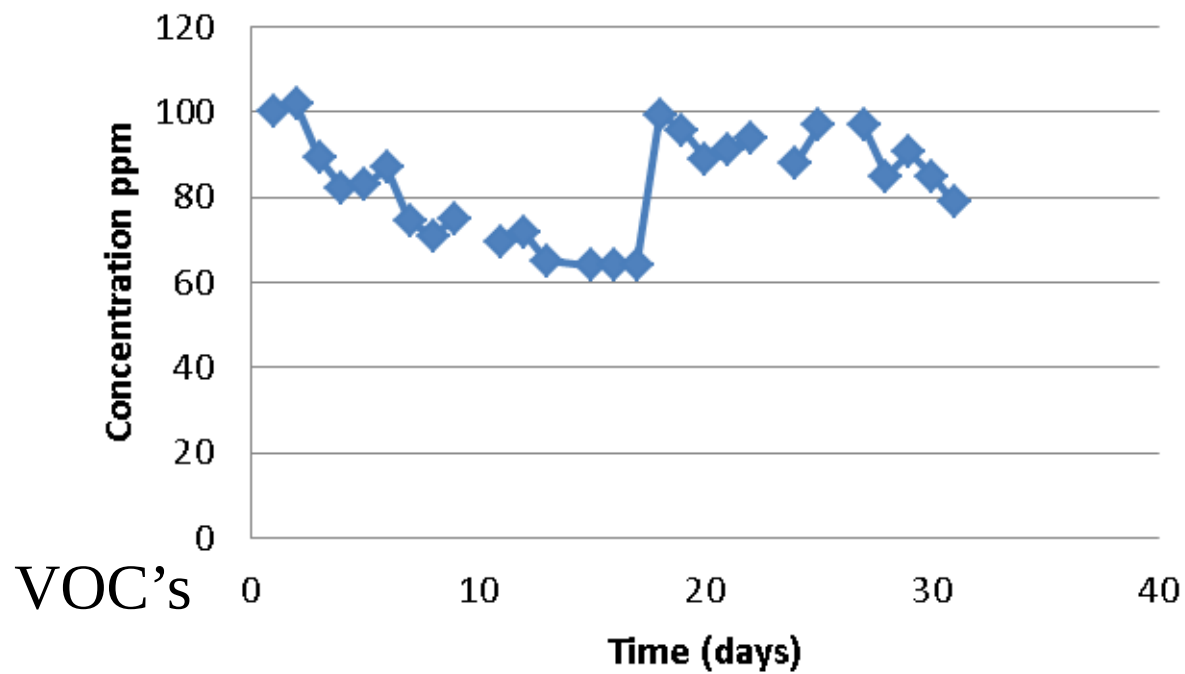


# Gases

|                 | Hydraulic Fracturing<br>/Flowback1 | Flowback    | Vertical Drill1 | Hydraulic Fracturing<br>/Flowback2 | Vertical Drill2 | Horizontal<br>Drill |
|-----------------|------------------------------------|-------------|-----------------|------------------------------------|-----------------|---------------------|
| O3 (8 hr avg)   | 9-56 ppb                           | 4-78 ppb    | 20-67 ppb       | 2-69 ppb                           | 11-61 ppb       | 14-56 ppb           |
| Nox (1 hr avg)  | 1.3-30 ppb                         | 3.4-12ppb   | 7.8-38 ppb      | 23-138 ppb                         | 9-151 ppb       | -                   |
| CH4 (6 day avg) | 2.1ppm                             | 2.0 ppm     | 2.0 ppm         | 2.0 ppm                            | 2.1 ppm         | 1.9 ppm             |
| SO2 (3 hr avg)  | 1.9-10.4ppb                        | 1.1-12.4ppb | 1.6-8.4 ppb     | 1.1-9.6 ppb                        | 1.7-3.7 ppb     | 2.1-5.3 ppb         |



## MiniRAE 3000 (C)



## CHRONIC MRL HAZARD QUOTIENTS



Frasco Summa–  
Promedio de 3 días  
Metodo EPA TO 15  
(Rpt. limite 0.5ppb  
Benzene)

@ 625 pies

| Pad                                 | site | RESUL<br>TS<br>ppb(v) | RESULT<br>S (ug/m3) | Hazard<br>Quotient | COMPOUN<br>D NAME |
|-------------------------------------|------|-----------------------|---------------------|--------------------|-------------------|
| Lewis Wetzel Three                  | 4    | 1.1                   | 3.6                 | 0.4                | Benzene           |
| Lewis Wetzel Three                  | 4    | 1.0                   | 3.3                 | 0.3                | Benzene           |
| Lewis Wetzel Three                  | 4    | 0.78                  | 2.5                 | 0.3                | Benzene           |
| <b>Lewis Wetzel Two</b>             | 3    | 3.0                   | 9.7                 | <b>1.0</b>         | Benzene           |
| Lewis Wetzel Two                    | 3    | 2.4                   | 7.8                 | 0.8                | Benzene           |
| Lewis Wetzel Two                    | 3    | 2.4                   | 7.7                 | 0.8                | Benzene           |
| Lewis Wetzel Two                    | 3    | 2.1                   | 6.7                 | 0.7                | Benzene           |
| <b>MAURY (Fracking)</b>             | 5    | 85                    | 270                 | <b>28.3</b>        | Benzene           |
| <b>MAURY (Fracking)</b>             | 5    | 49                    | 160                 | <b>16.3</b>        | Benzene           |
| <b>MAURY (Fracking)</b>             | 5    | 12                    | 39                  | <b>4.0</b>         | Benzene           |
| <b>WEEKLEY (Fracking)</b>           | 2    | 8.2                   | 26                  | <b>2.7</b>         | Benzene           |
| <b>WEEKLEY</b>                      | 2    | 4.5                   | 14                  | <b>1.5</b>         | Benzene           |
| <b>WEEKLEY</b>                      | 2    | 4.2                   | 13                  | <b>1.4</b>         | Benzene           |
| <b>WEEKLEY</b>                      | 2    | 3.9                   | 12                  | <b>1.3</b>         | Benzene           |
| <b>WEEKLEY</b>                      | 2    | 2.9                   | 9.2                 | <b>1.0</b>         | Benzene           |
| <b>WVDNR<br/>(Horizontal Drill)</b> | 7    | 13                    | 41                  | <b>4.3</b>         | Benzene           |
| <b>WVDNR</b>                        | 7    | 3.0                   | 9.5                 | <b>1.0</b>         | Benzene           |
| <b>DONNA</b>                        | 1    | 2.2                   | 7.0                 | 0.7                | Benzene           |
| <b>DONNA</b>                        | 1    | 2.1                   | 6.8                 | 0.7                | Benzene           |
| <b>DONNA</b>                        | 1    | 1.7                   | 5.3                 | 0.6                | Benzene           |
| <b>LEMON (Vertical<br/>Drill)</b>   | 6    | 15                    | 48                  | <b>5.0</b>         | Benzene           |

CHRONIC MRL = 3ppb; INTERMEDIATE = 6 ppb; ACUTE = 9  
ppb  
365 days + 14-364 days 1-14 days





# Ruido

- EPA identifica un límite de exposición durante 24-hour de 70 decibeles para evitar la pérdida del oído durante la vida

[illegible]

**Niveles Máximos de Ruido**  
**Requeridos por by}} EPA en Camiones**  
**Que pesan más de 4,525 Kilogramos**  
**(40CFR202)**

| Velocidad    | Maximo Ruido a 15 Metros |
|--------------|--------------------------|
| < 56 kph     | 83 dBA                   |
| > 56 kph     | 87 dBA                   |
| Estacionário | 85 dBA                   |

**ACTIVIDAD A 625 PIES DEL POZO**



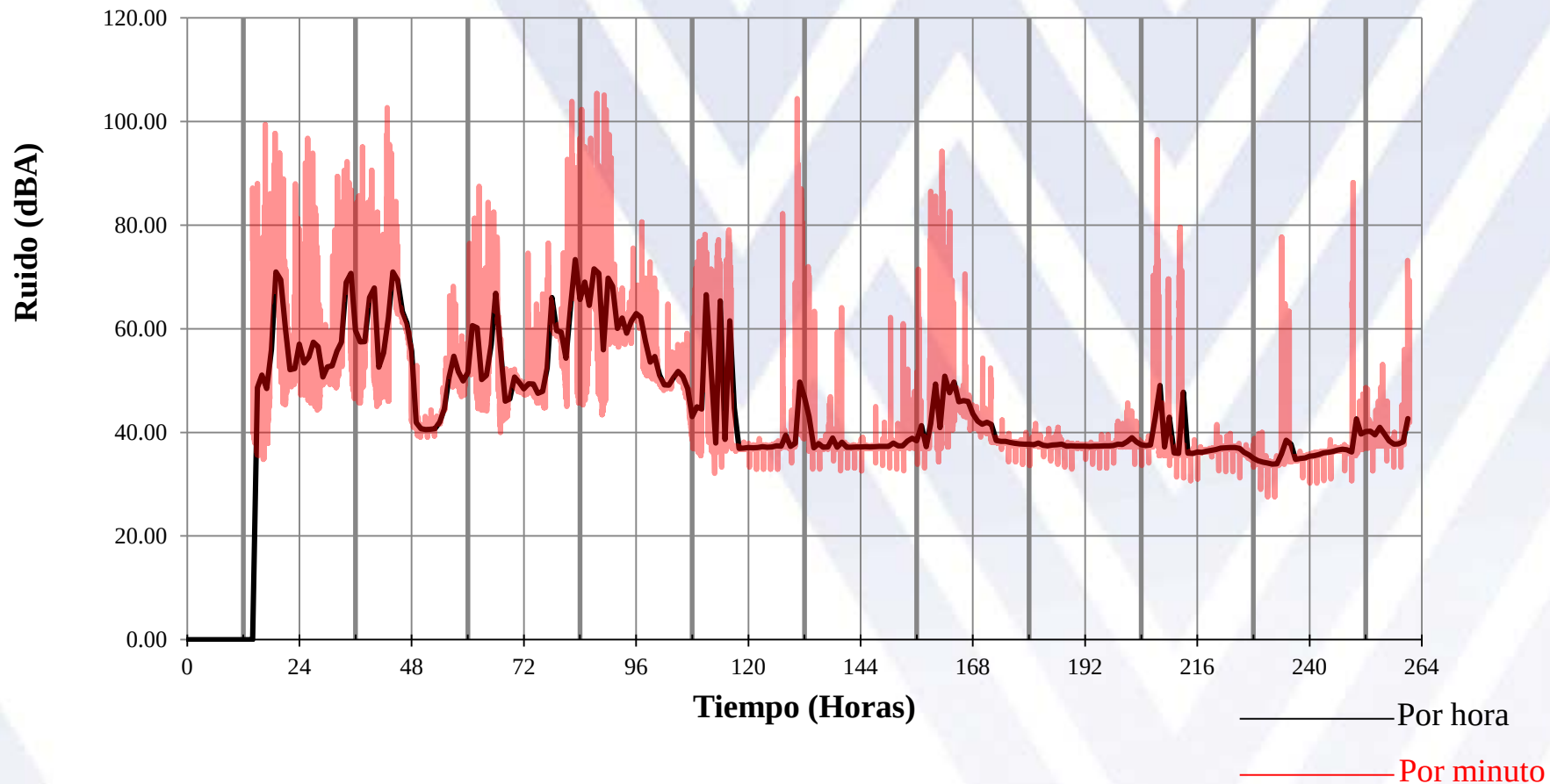
# RUIDO

## PROMEDIO DE TODO EL PERIODO DE MUESTREO

|                       | Hydraulic<br>Fracturing/Flowback1 | Vertical<br>Drilling1 | Pad Preparation | Hydraulic<br>Fracturing/Flowback2 | Vertical<br>Drilling2 |
|-----------------------|-----------------------------------|-----------------------|-----------------|-----------------------------------|-----------------------|
| Mean (dBA)            | 46                                | 57                    | 68              | 53                                | 54                    |
| Standard<br>Deviation | 12                                | 7                     | 10              | 6                                 | 6                     |



# Fracturación Hidráulica/Flowback1



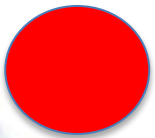


# Hydraulic Fracturing

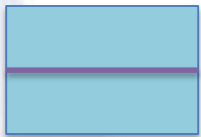
| Site A (near impoundment above pad) |                             |                   | Site C (near road)               |                             |                   | Site D (1200 ft from pad)        |                             |                   |
|-------------------------------------|-----------------------------|-------------------|----------------------------------|-----------------------------|-------------------|----------------------------------|-----------------------------|-------------------|
| time above sound level (minutes)    | % of time above sound level | sound level (DbA) | time above sound level (minutes) | % of time above sound level | sound level (DbA) | time above sound level (minutes) | % of time above sound level | sound level (DbA) |
| 53                                  | 0.4                         | 90                | 6                                | 0.04                        | 90                | 3                                | 0.02                        | 90                |
| 191                                 | 1.3                         | 80                | 52                               | 0.35                        | 80                | 19                               | 0.13                        | 80                |
| 644                                 | 4.3                         | 70                | 930                              | 6.26                        | 70                | 138                              | 0.93                        | 70                |
| 2277                                | 15.3                        | 60                | 4949                             | 33.32                       | 60                | 658                              | 4.44                        | 60                |
| 4261                                | 28.7                        | 50                | 11331                            | 76.30                       | 50                | 2760                             | 18.63                       | 50                |
| 7353                                | 49.5                        | 40                | 12048                            | 81.13                       | 40                | 10028                            | 67.68                       | 40                |
| 14845                               | 100                         | 30                | 14851                            | 100.00                      | 30                | 14817                            | 100.00                      | 30                |

| Pad Construction                 |                             |                   | Away from Construction (near road) |                             |                   |
|----------------------------------|-----------------------------|-------------------|------------------------------------|-----------------------------|-------------------|
| time above sound level (minutes) | % of time above sound level | sound level (DbA) | time above sound level (minutes)   | % of time above sound level | sound level (DbA) |
| 68                               | 0.80                        | 90                | 1                                  | 0.01                        | 90                |
| 855                              | 10.07                       | 80                | 7                                  | 0.08                        | 80                |
| 4046                             | 47.63                       | 70                | 242                                | 2.85                        | 70                |
| 7045                             | 82.94                       | 60                | 3336                               | 39.27                       | 60                |
| 8416                             | 99.08                       | 50                | 8202                               | 96.56                       | 50                |
| 8494                             | 100.00                      | 40                | 8482                               | 99.86                       | 40                |
| 8494                             | 100.00                      | 30                | 8494                               | 100.00                      | 30                |





Pozo



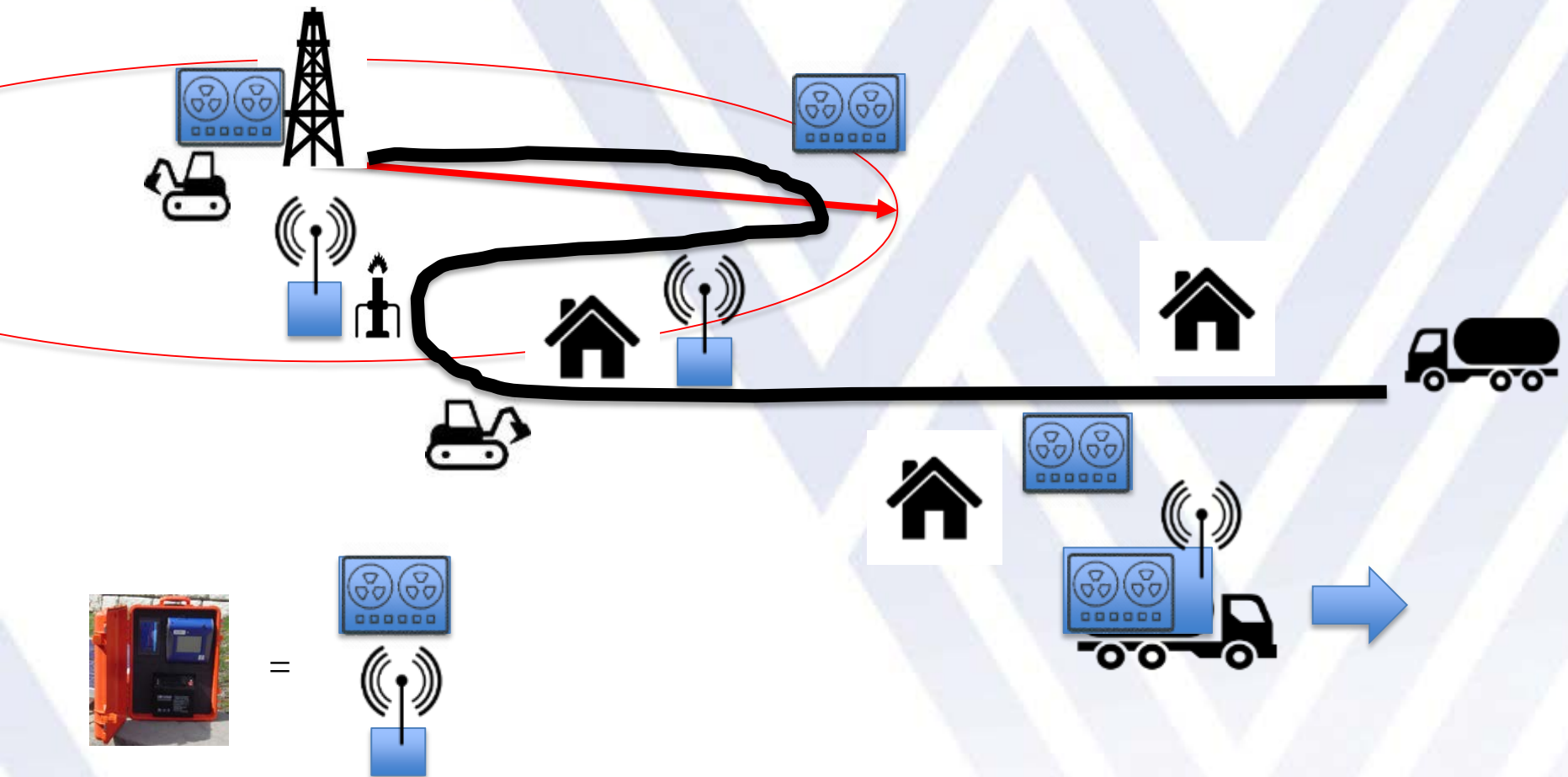
Carretera



# Estratégia de Muestreo



## Sitios de Muestreo







¿ ? ?  
¿ QUESTIONS ?  
? ? ¿

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## PM2.5 $\neq$ Dosis al pulmón

