

○ Air quality, a key for a sustainable geothermal energy development

French Framework

Guillaume Ravier – ES-Géothermie
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○ Regulation Framework

- Mix of national regulatory frameworks : Mining, Environmental and Labor Codes
- Different regional regulations in Drilling Permits and Exploitation Permits
- H₂S and CH₄:
 - National: General Regulations on Extractive Industries
 - Local: Drilling/Exploitation permits
- Radionuclides:
 - National: Ministerial decree 2006-649
 - General Regulation on Extractive Industries
- Other aeriform emission:
 - Smell, regulation in Drilling/Exploitation permits
 - No regulation for Hg, As, B, Sb
 - But no plant with Hg, As, B and Sb emission

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○ Regulatory requirements during drilling

- All olfactory nuisance must be prevented (drilling permit)
- Drilling rig must be equipped with:
 - a BOP to prevent any gas blowout
 - a Mud Gas Separator, a torch and a windsock
 - a H₂S and CH₄ monitoring (1 to 3 stations)
- Monitoring: Continuous air quality monitoring during drilling
- Thresholds: 10 ppm for H₂S
- Site manager applies the appropriate safety instructions
- Safety exercises during drilling
- Exemption possible if safety is proven
- Public data: No, only for mining authorities



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○ Regulatory requirements during operation

- Design and operation to prevent any olfactory nuisance (exploitation permit)
- In case of H₂S risk, regulatory requirement in the exploitation permit
- Only one case in France:
 - Bouillante power plant in Guadeloupe island
 - Volcanic context with existing hot spring and fumaroles
 - Flash plant
- Monitoring:
 - Continuous onsite monitoring
 - Annual campaign around the plant
- Thresholds:
 - 2 for onsite workers (5 and 10 ppm)
 - 2 around the plant based on World Health Organisation and OEHHA
- Public data: No, only for mining authorities

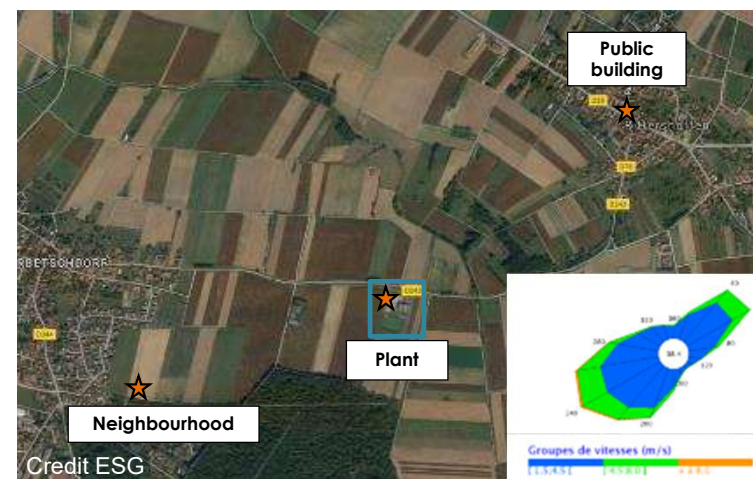


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○ Regulatory requirements during operation

- In case of radionuclides risk, regulatory requirement in Ministerial decree 2006-649
- Only plants in the Upper Rhine context concern:
 - Granitic context
 - Presence of ^{226}Ra and daughter isotopes in aeriform emissions
 - But minimal risk (pressurized closed geothermal loop)
- Monitoring:
 - Annual campaign onsite and around the plant
 - On closest public buildings and neighbourhood in the prevailing wind
- Thresholds:
 - Not define
- Public data: No, only for mining authorities



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○ Situation regarding GEOENVI's recommendations

- Air quality monitoring during well drilling → Mandatory (H₂S and CH₄)
- Installation of BOP at wells and trained personnel → Mandatory
- Air-quality monitoring during well flow tests → Not clearly mandatory
- Data reporting to the authority → Mandatory
- Air quality baseline → Mandatory for H₂S and radon, not mandatory for CO₂ and metals (Hg...)
- Continuous or frequent air quality check → Mandatory in case of risk of H₂S or radon
- Abatement plans to contain emissions → Plants should be operated with lowest possible air emissions, but abatement systems not clearly mandatory
- Total reinjection → Not mandatory for gas

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○ Thank you for your attention

Guillaume Ravier

guillaume.ravier@es.fr

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