

26th World Gas Conference

1 – 5 June 2015, Paris, France



Unconventional Gas – Environment / Water focus

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SUEZ environnement

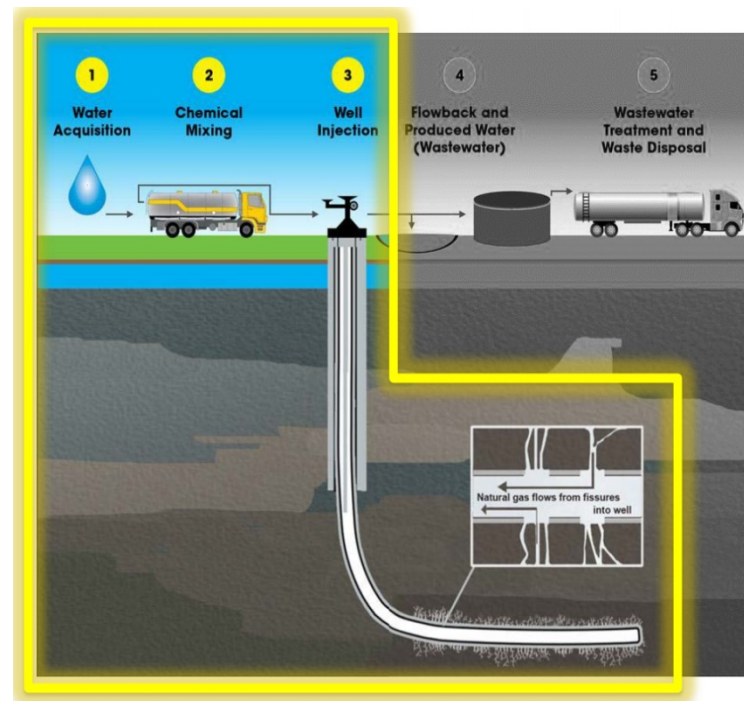


Unconventional Gas – Environment / **Water** focus

Part 1

Hydraulic fracturing

Some environmental challenges



Source US EPA 2015

Environmental challenges / Water stress

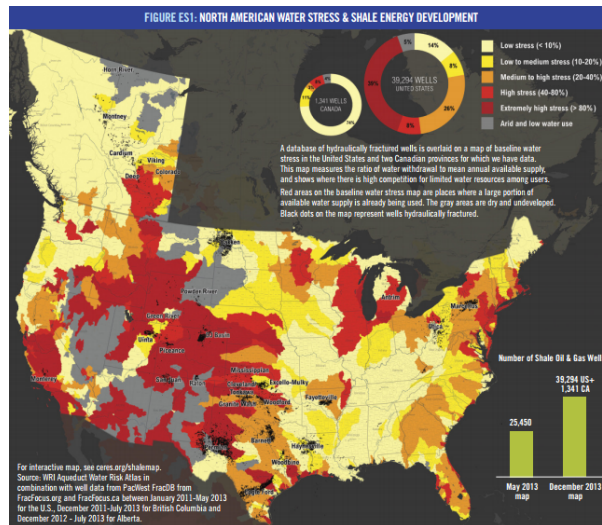
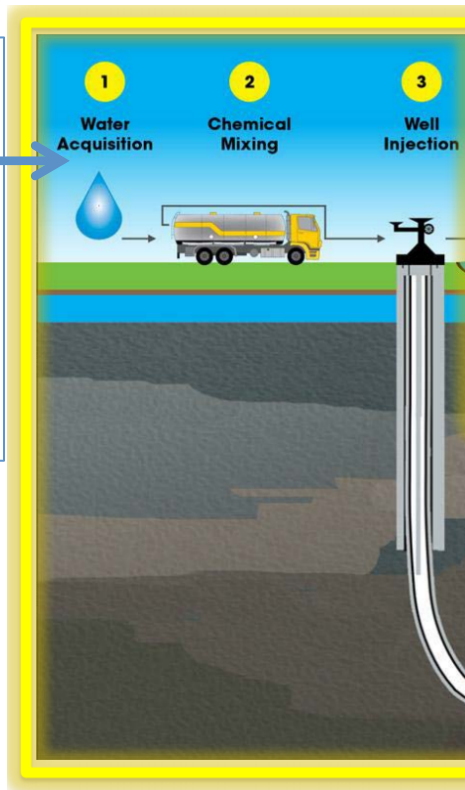
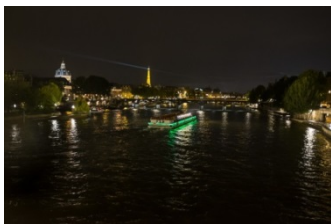
Water availability

- Average 11,000 m³/ gas well in the U.S*
- 30 seconds of the river Seine in Paris.
- Acceptable in some places, not in others

Requirements

- Local solutions
- Alternative water resources
- Less water intensive fracking processes
- Flowback / produced water reuse

* From FracFocus statistics : Analysis of Hydraulic Fracturing Fluid Data from the FracFocus Chemical Disclosure Registry 1.0, March 2015



Nearly half of the wells hydraulically fractured since 2011 in regions with high or extremely high water stress, and over 55 percent were in areas experiencing drought. (CERES report Feb. 2014)

Environmental challenges / Aquifer protection

Protection of aquifers

- Some reported cases of aquifer contamination in PA and NY (publications by PNAS* in 2011 and 2015)

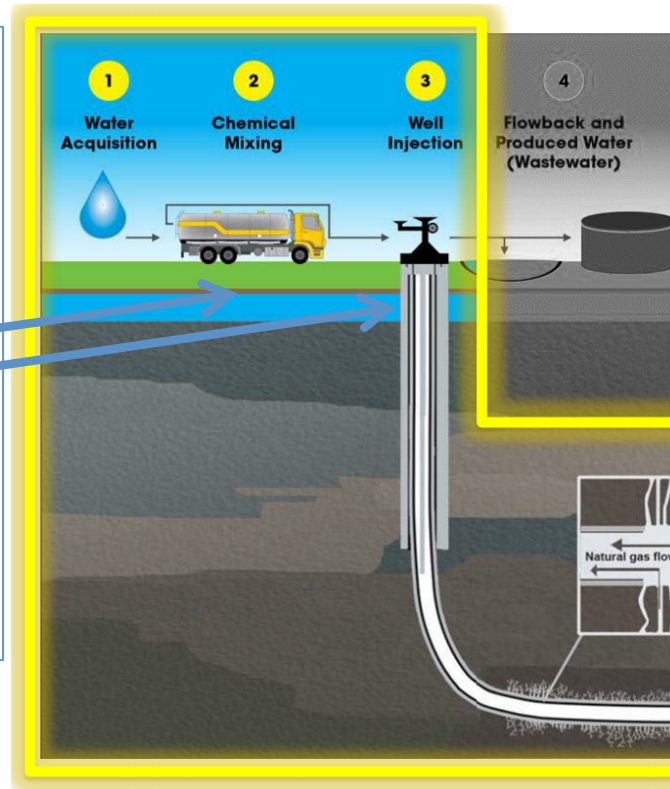
Possible causes

- Surface spillages during operations
- Leakages at storage pits
- Poor well completion

Requirements

- Adequate baseline / monitoring of the aquifer quality,
- Suitable chemistry,
- Adequate pad protection,
- Proper well completion.

*PNAS : Proceedings of the National Academy of Sciences of the USA



May 15, 2015

ShaleENERGY INSIDER

**Defend Your Business Against a
EXHIBIT: 2015 SOUTH TEXAS O**

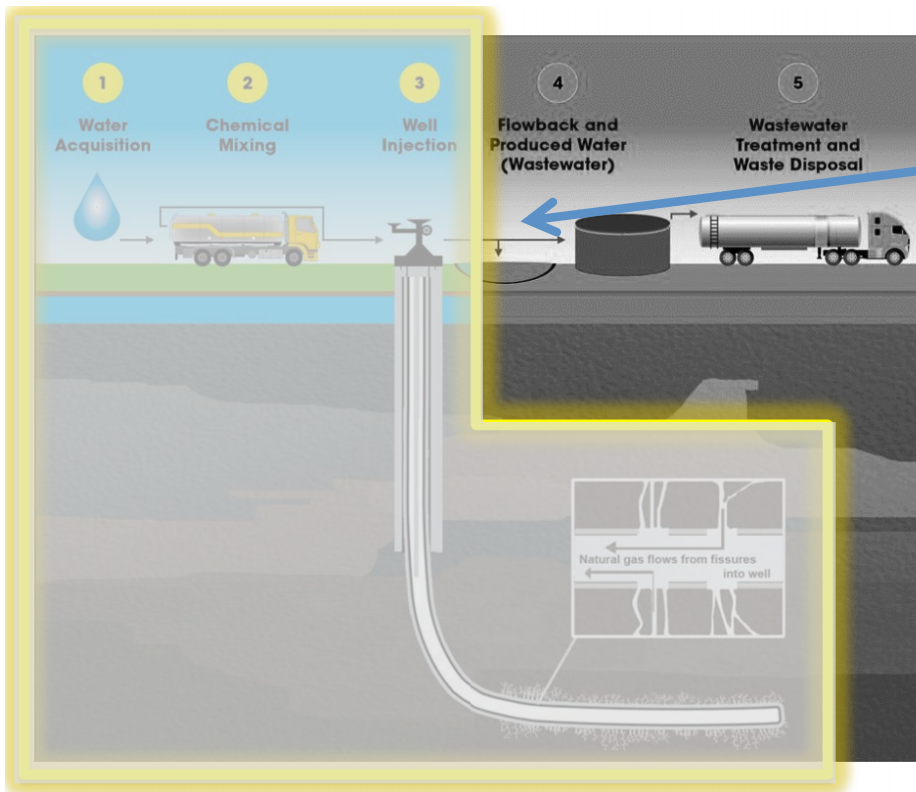
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Fracking poses "major uncertainties" for health and the environment, warns DEC

FRAC TRACKER
alliance

11% of organic farms near drilling in US, potentially 31% in future

Environmental challenges / Effluents



Environment protection

- Highly variable flowback / produced water quality.
 - Hydrocarbons, BTEX, HM, NORMs
 - Salinity up to 300 g/l
- Gas emissions : BTEX, ...

Treatment

- Deep well reinjection (initial method)
- **Reuse** (common and future practice)
- **Advanced treatments** for discharge to environment.

Requirements

- ➔ Knowledge of produced water management.
- ➔ Limit gas emissions
- ➔ Centralized dedicated plants (merchant plants...) or temporary (mobile) local treatment plants
- ➔ Ultimate salts/residue disposal.

Part 2

Some solutions and remaining challenges

Water stress : alternative water resources

Limit water abstraction :

- New fracturing techniques requiring less water.
- Flowback / produced water reuse
- Alternative water resources
 - Municipal or industrial effluents reuse
 - Produced water from conventional fields
 - Saline aquifers
 - Mine influenced waters

➔ “*Select sources rationally and transparently (*)*”

(*) P. Charlez – P. Baylocq, *The shale oil and gas debate*

... **Early disclosure and dialogue should prevail.**



White Paper: Utilization of Mine Influenced Water for
Natural Gas Extraction Activities

Title: Establishment of a Process for Evaluating the Proposed Use of Mine Influenced Water (MIW) for Natural Gas Extraction.¹



El Secundo wastewater recycling facility – Suez environnement

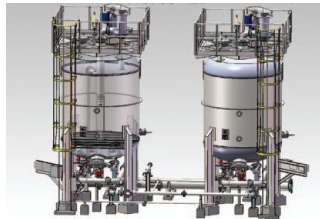
Produced water treatment



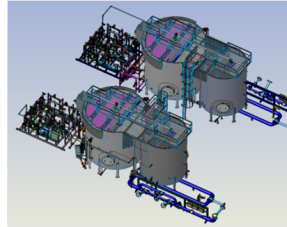
Desander – deoiler cyclones



Induced Gas or Dissolved Gas Flotation



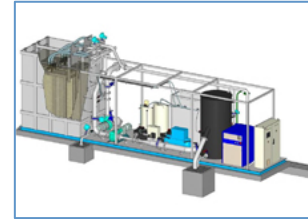
Nutshell or sand Filtration



Densatdeg for
Solids / Hardness / NORMs /
HM removal



Electrocoagulation
for specific treatments



Membrane bioreactor
for polishing of dissolved
organics



Skid or trailer mounted
membrane or resin based units



Ozone generator, UV for
disinfection as alternative to
biocides



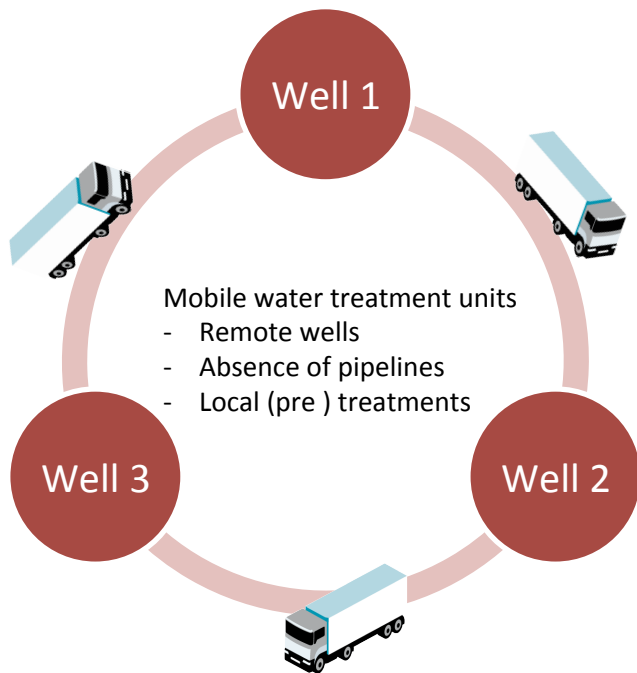
Evaporator / Crystallizer

From water/oil/solids separation ...

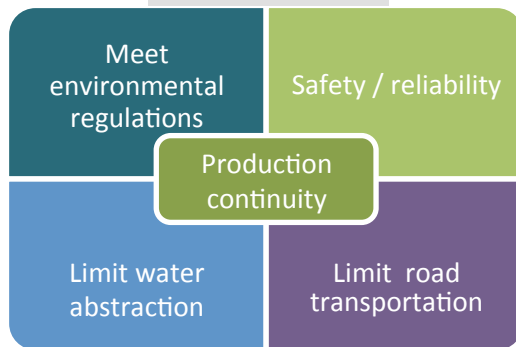
... to ultrapure water production and Zero Liquid Effluent Discharge

Water treatment services to face water challenges

Mobile



Objectives

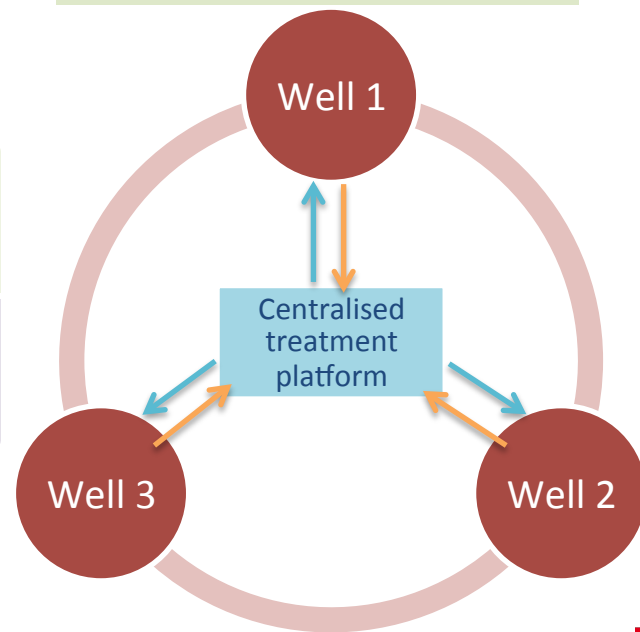


EPA seeks to ban fracking wastewater from going to public treatment plants

April 9, 2015 12:00 AM

<http://powersource.post-gazette.com/>

Fixed



→ Flowback water (for treatment)

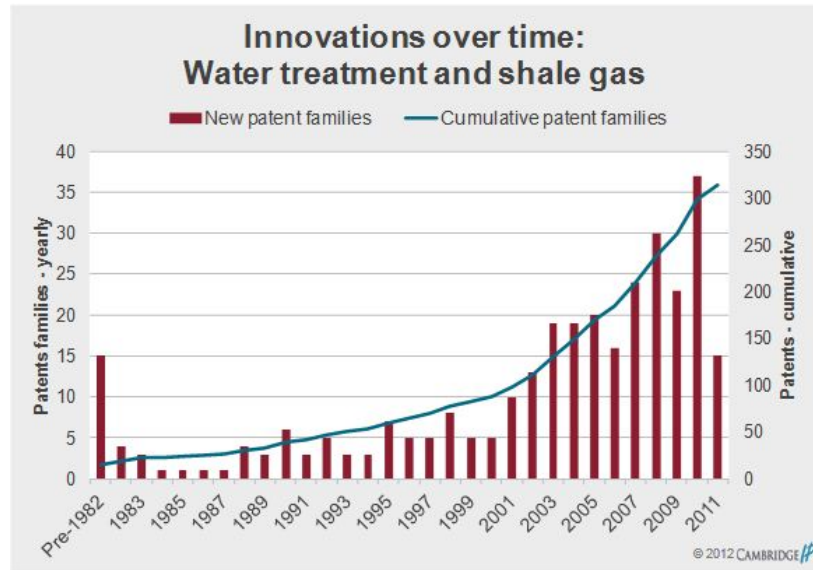
→ Treated water (reuse water for injection)

Produced water treatment - innovation

- The oil&gas industry is a great target for innovative companies.
- Many investments and announcements during the past 5 years
- New produced water treatment technologies such as ultrafiltration (oil, solids), forward osmosis (salts, metals), liquid extraction (salts...).



Suez environnement produced water R&D center



Technology ... and adequate management

- **Anticipation**
- **Disclosure and transparency**
- **Dialogue with stakeholders**
- **Operational practices - Monitoring - Control**
- **Lessons learnt**
- **Take in consideration local specificities.**



THANK YOU

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