

Fracking 101

Hydrofracking

and

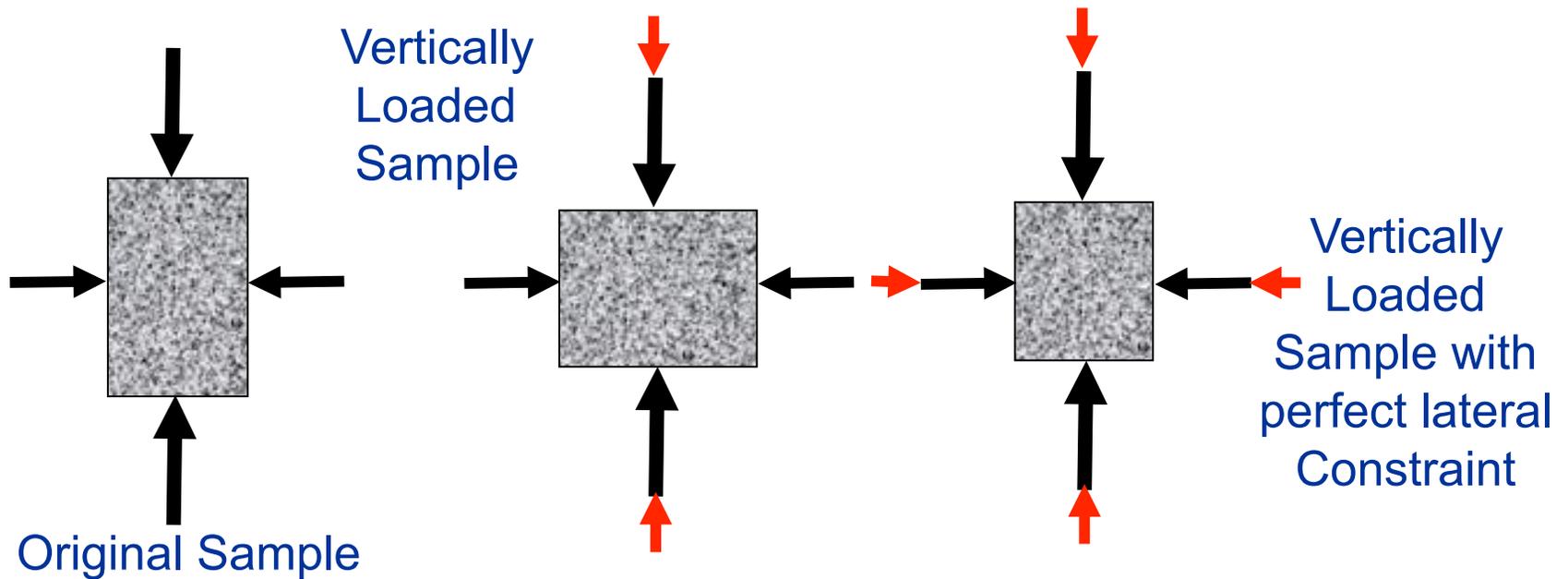
The Natural System

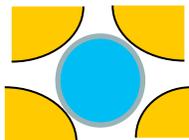
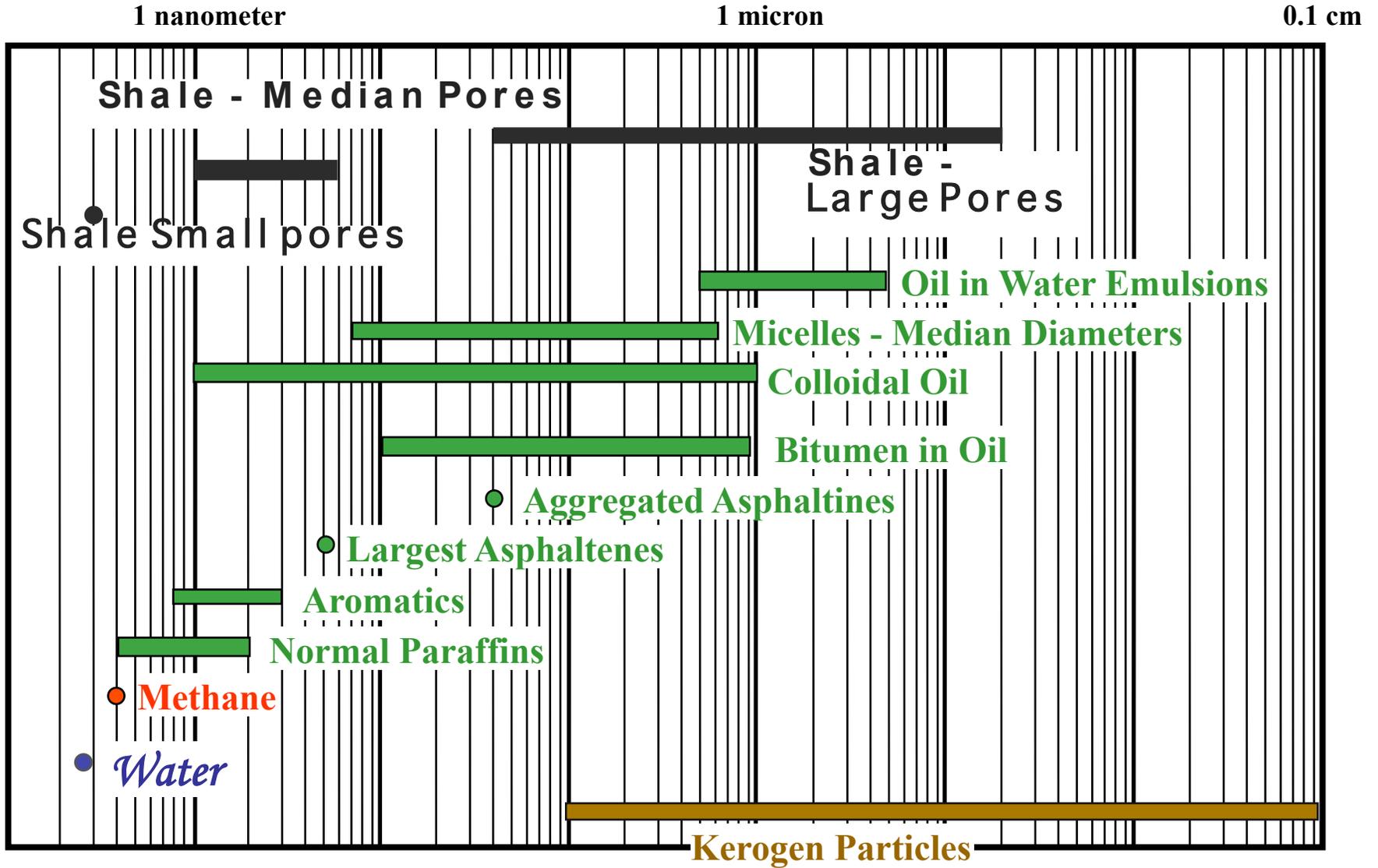
Shale Gas and America's Future

A Few Basics

**Dr. Martin Matthews,
Retired Geologist
April 2013**

Rock compressional stress during burial





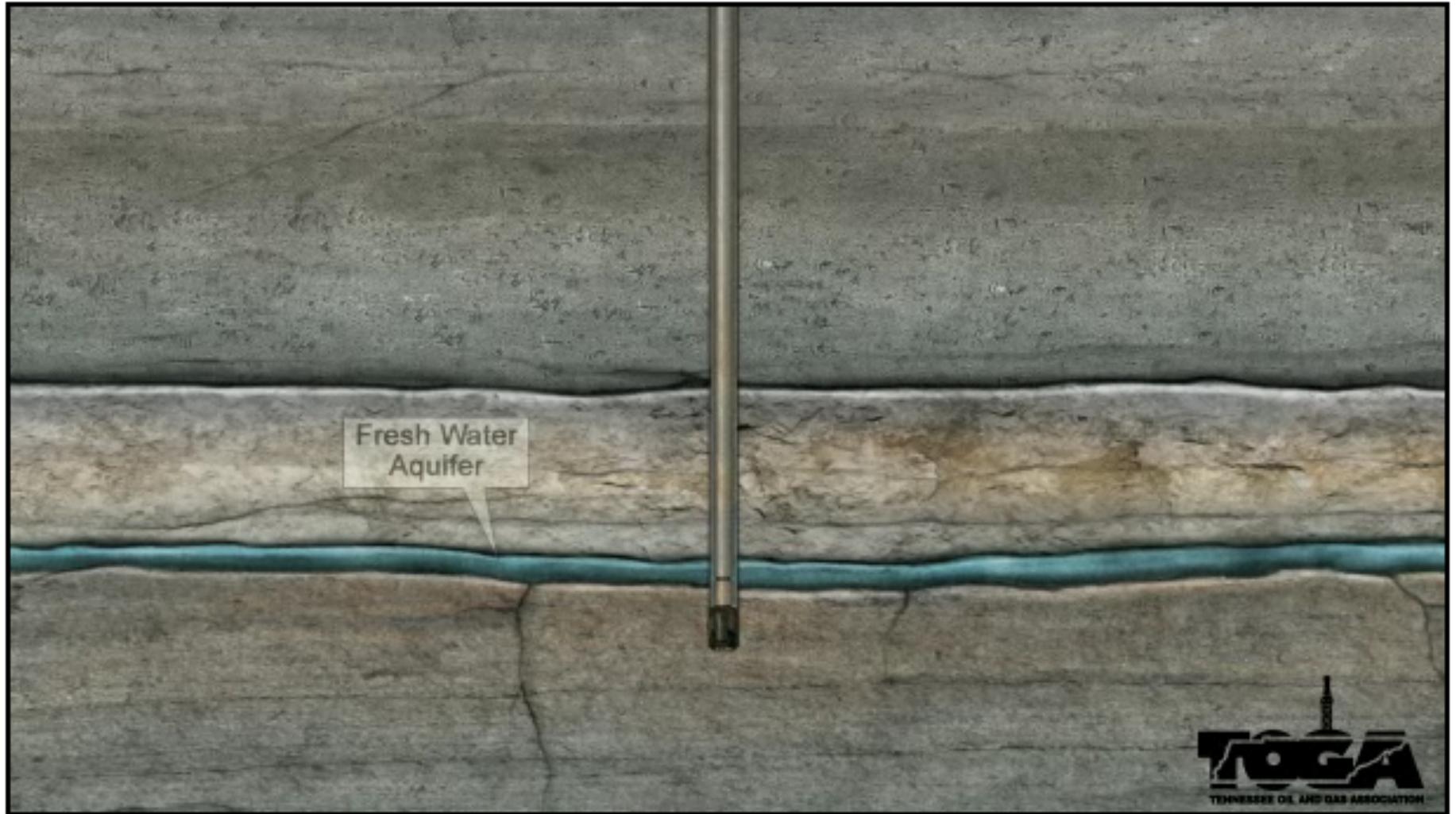


Hydro Fracking

Industry Experience

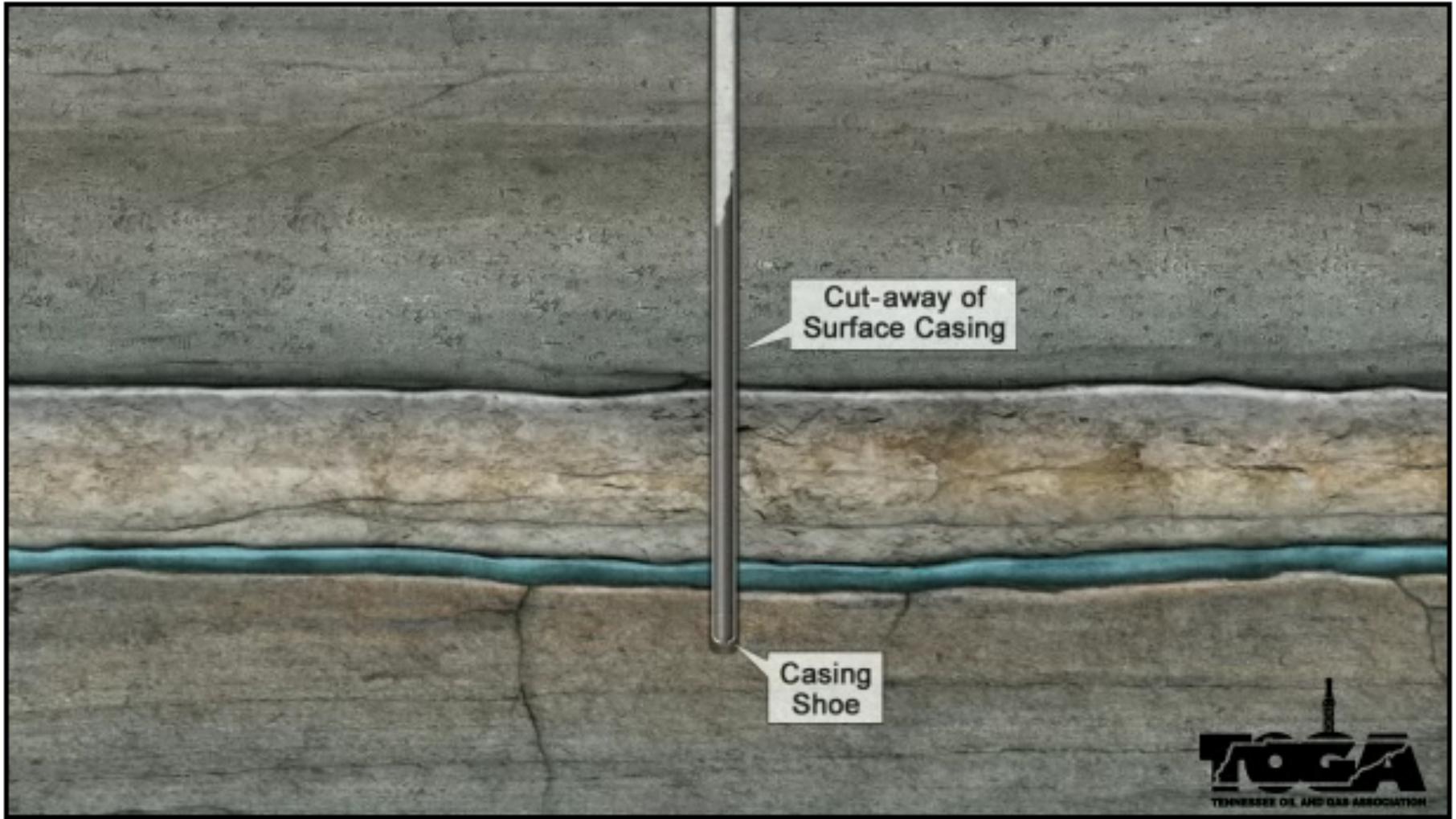
- **Fracturing by pressure has been performed for over 60 years**
- **More than a million wells have been fractured**
- **Fracturing fluids typically used in our operations contain approximately 99.5 percent water and sand, and 0.5 percent special purpose additives. These ingredients are necessary to reduce friction, prevent bacterial growth, and minimize scale formation that can corrode pipes.**
- **Ingredients are known, not amounts, like can labels**

Drill through aquifer

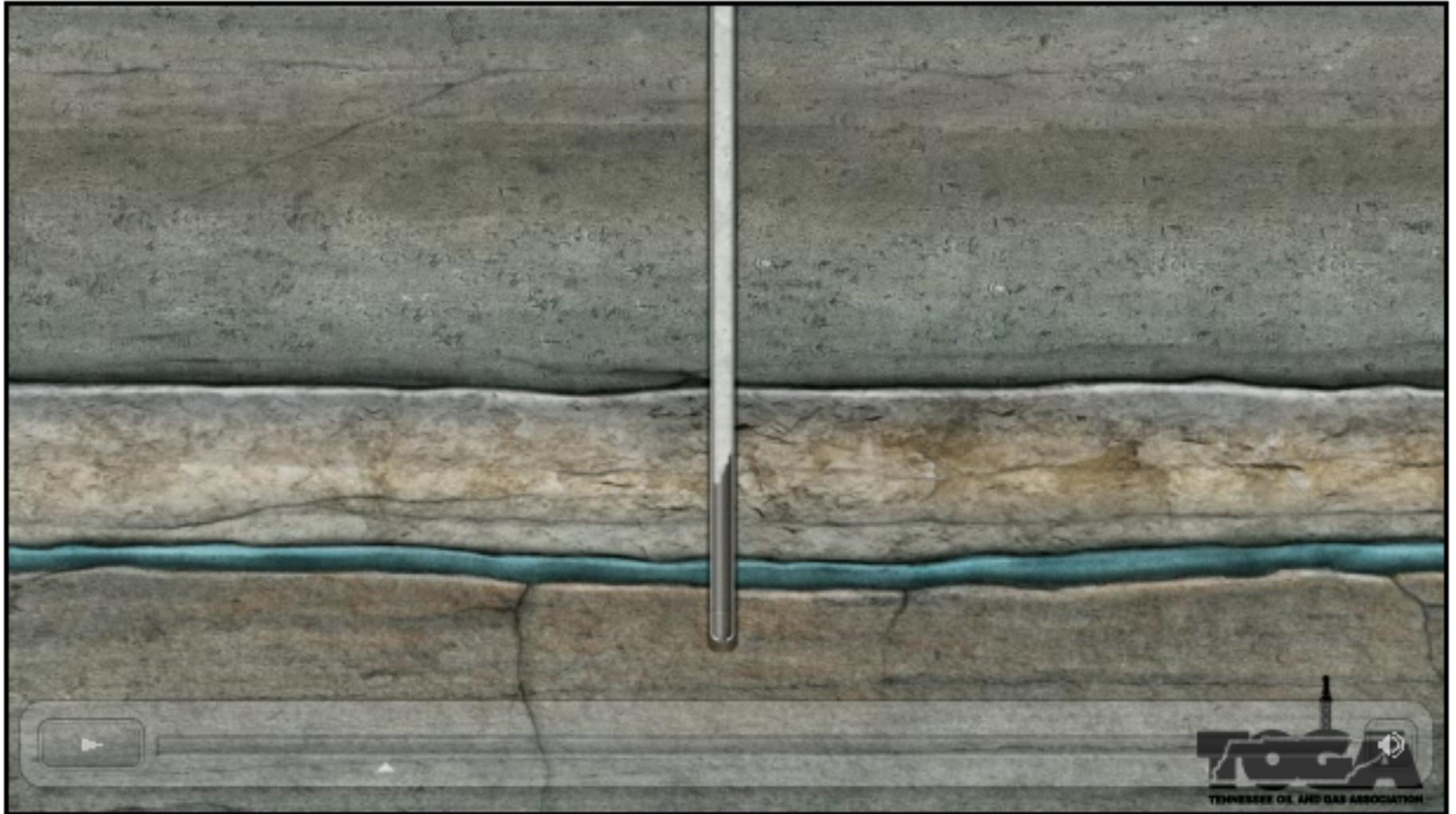


<http://www.tennoil.com/flash/shale.htm>

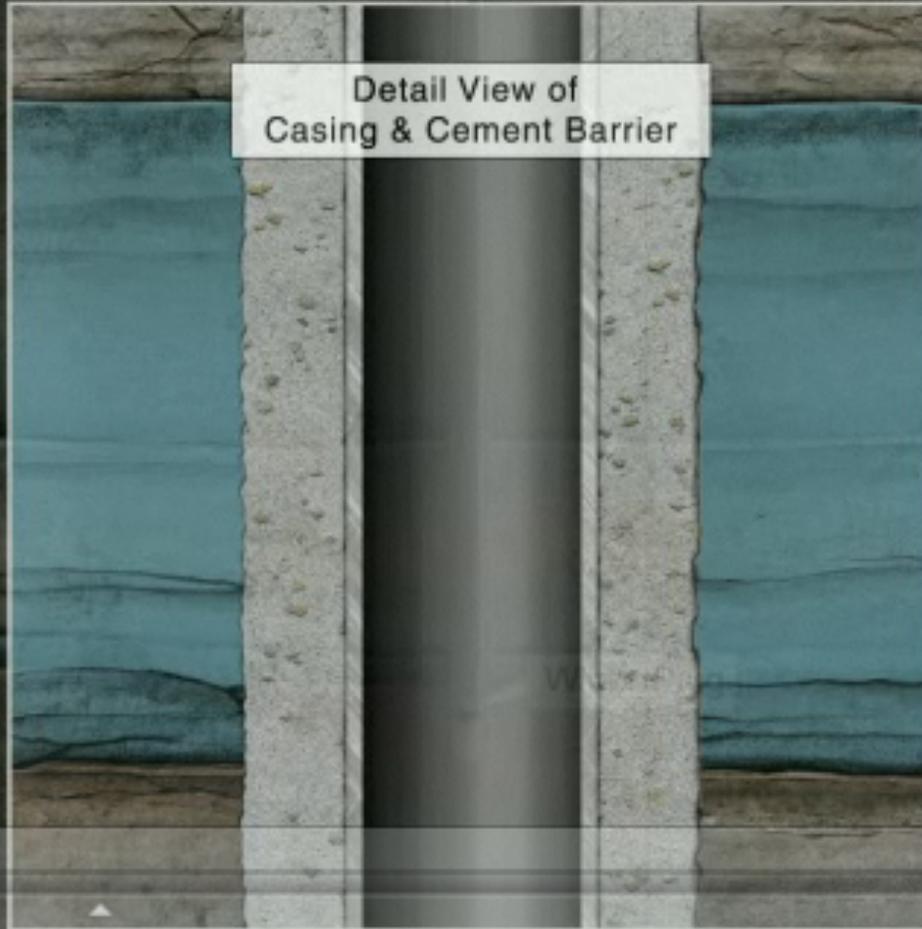
Case off aquifer



Squeeze cement between casing and rock

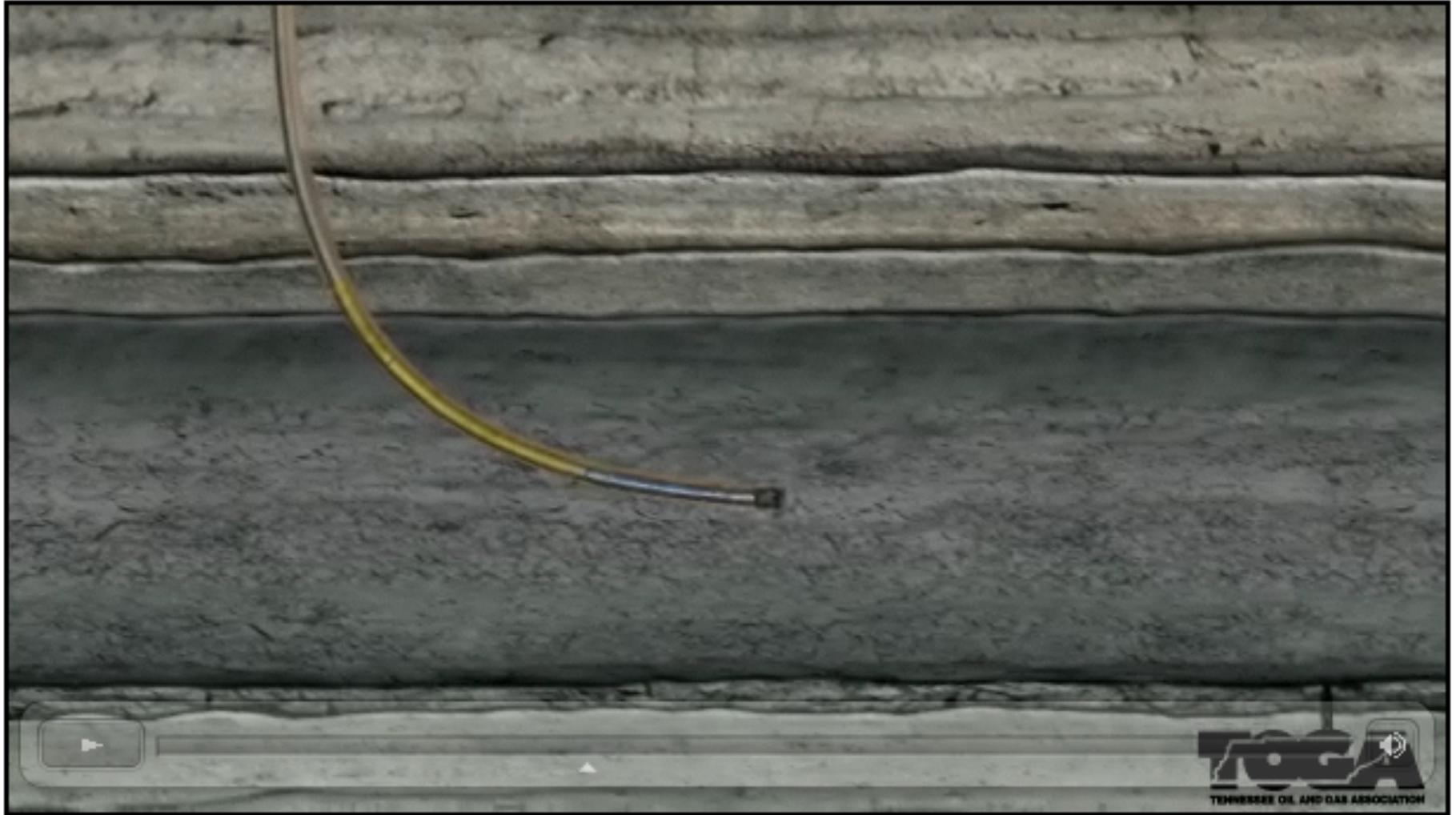


Detail View of
Casing & Cement Barrier



TECHNICAL SERVICES ASSOCIATION

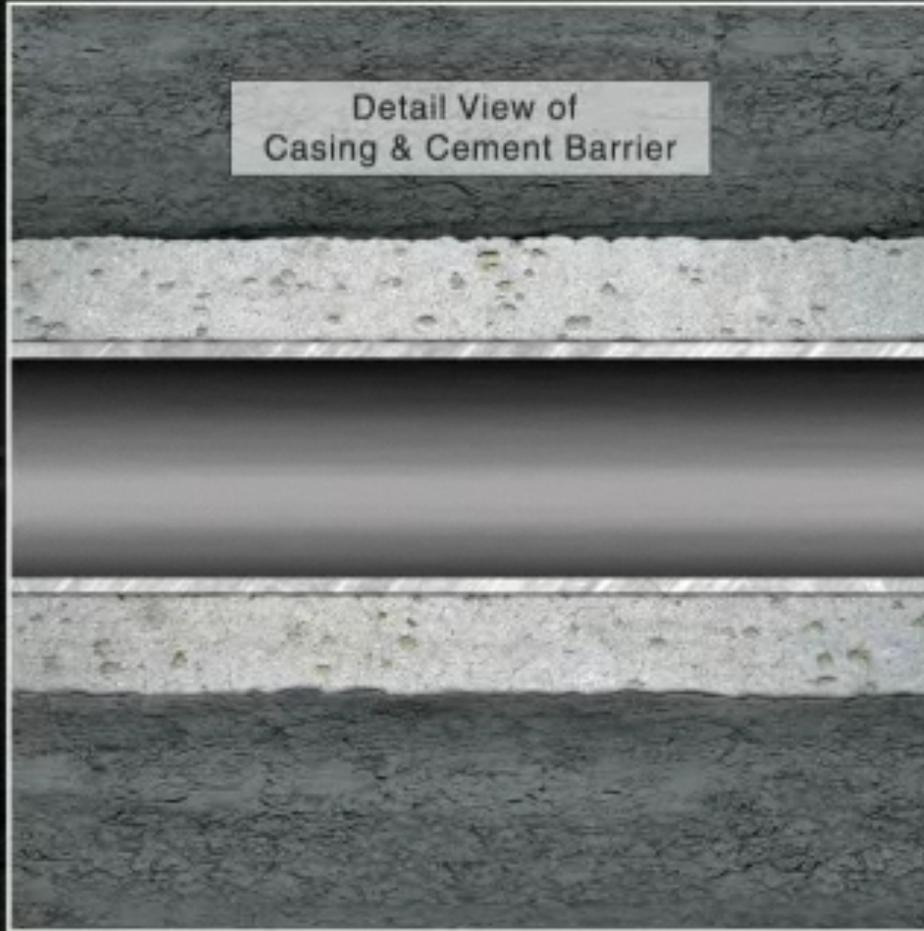
Turn hole and set horizontal depth



Drill, case, squeeze to end of horizontal reach



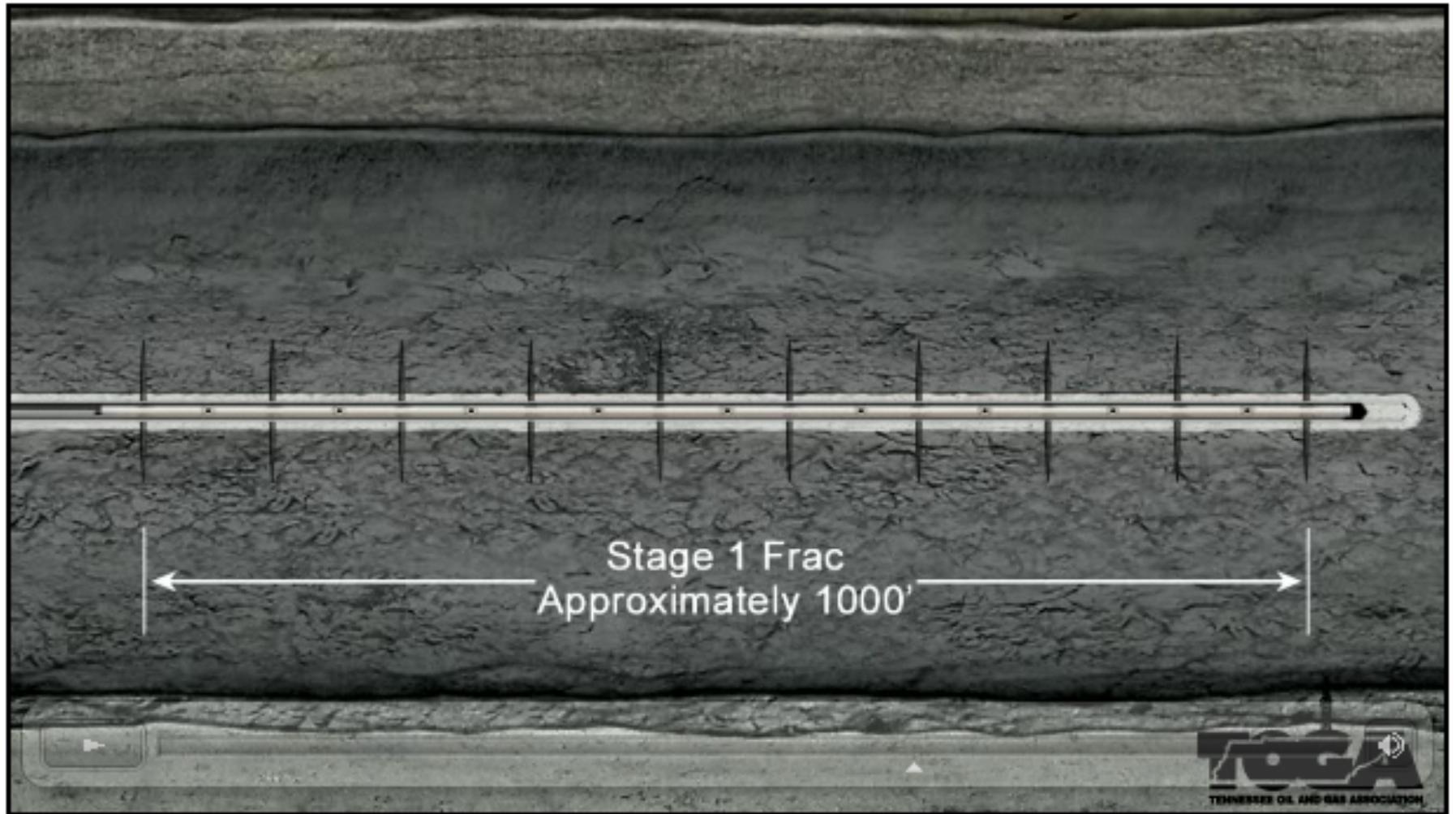
Detail View of
Casing & Cement Barrier



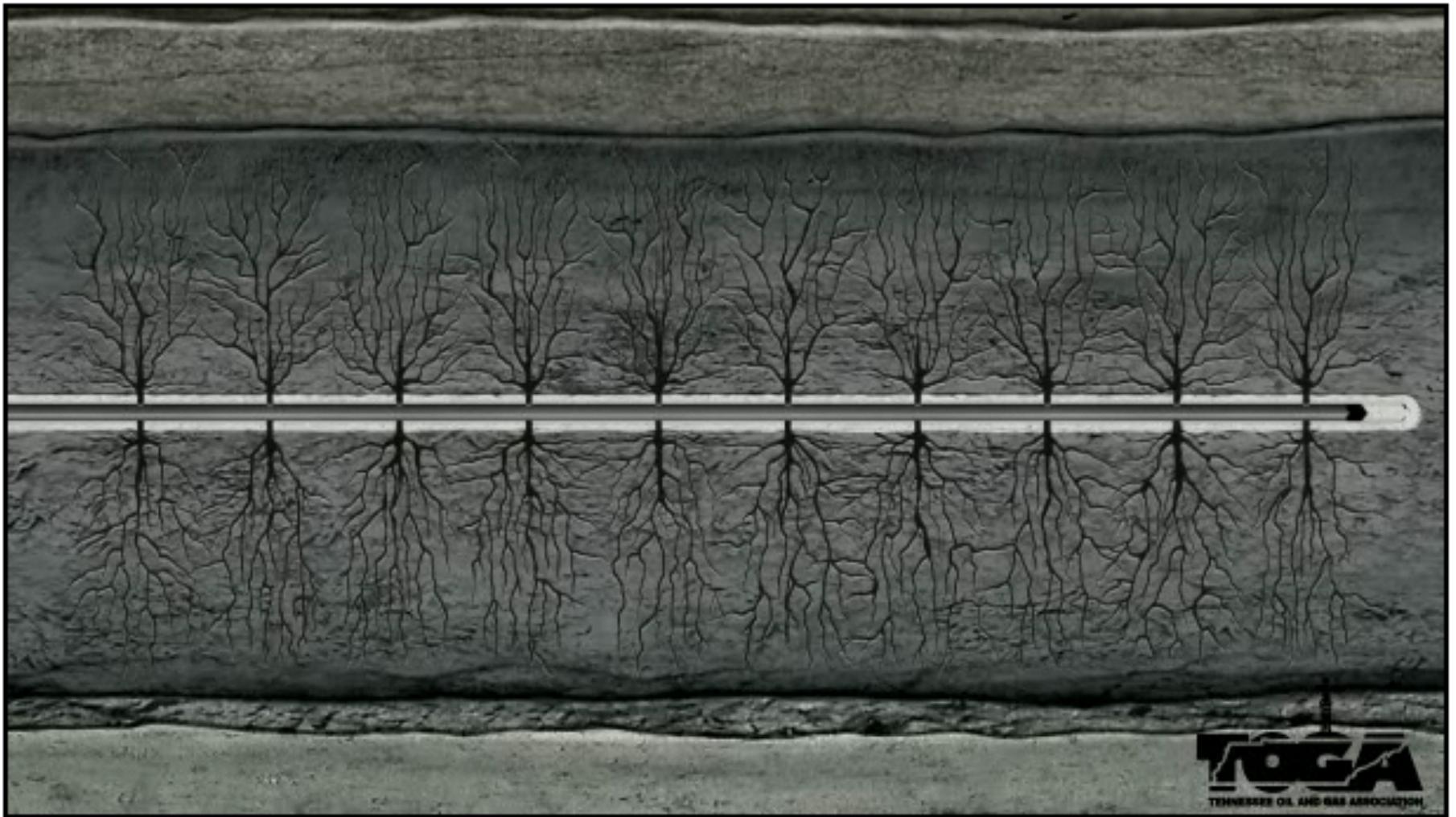
Perforate casing and cement From end of horizontal reach



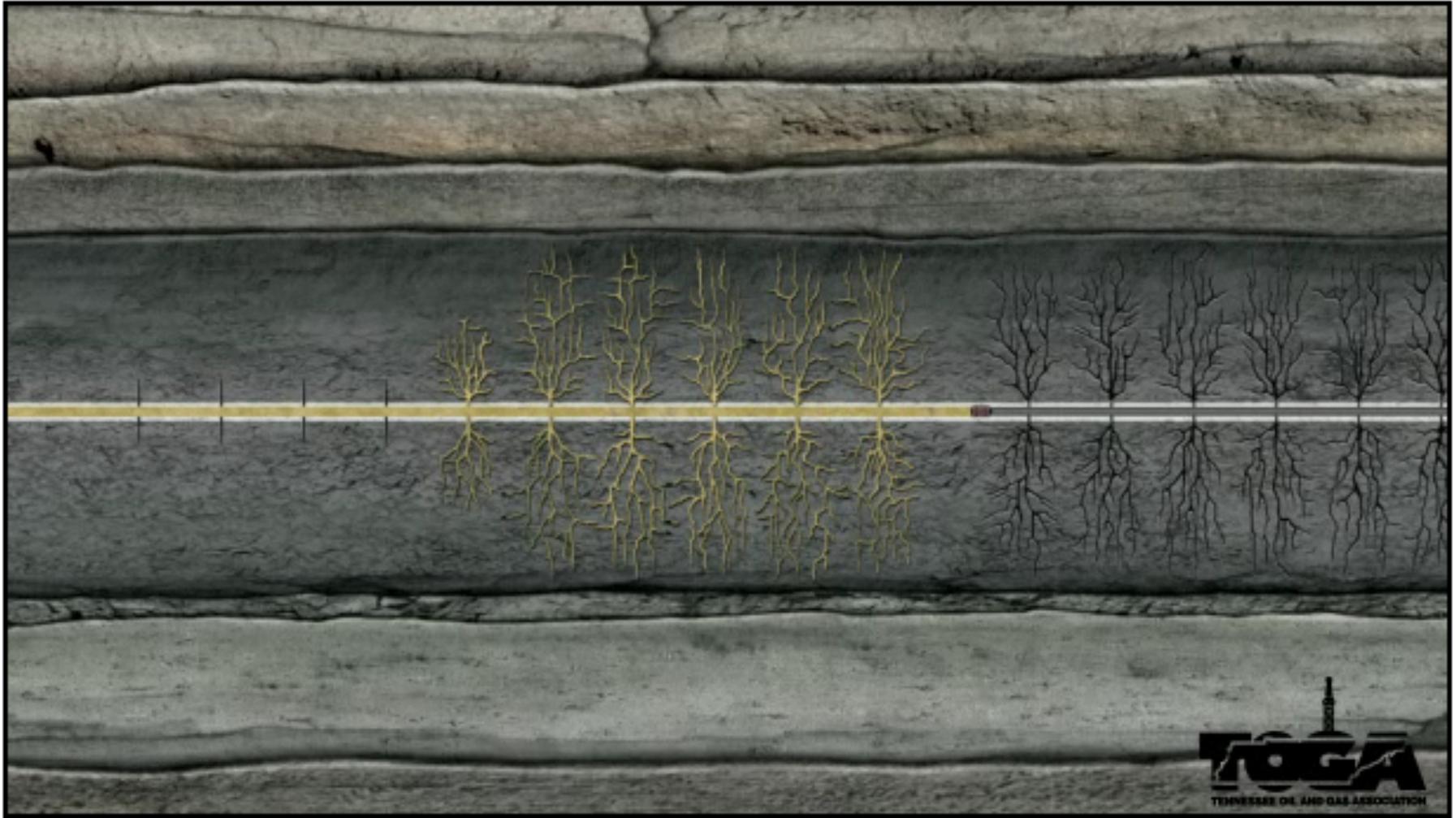
Pump up pressure to fracture rock

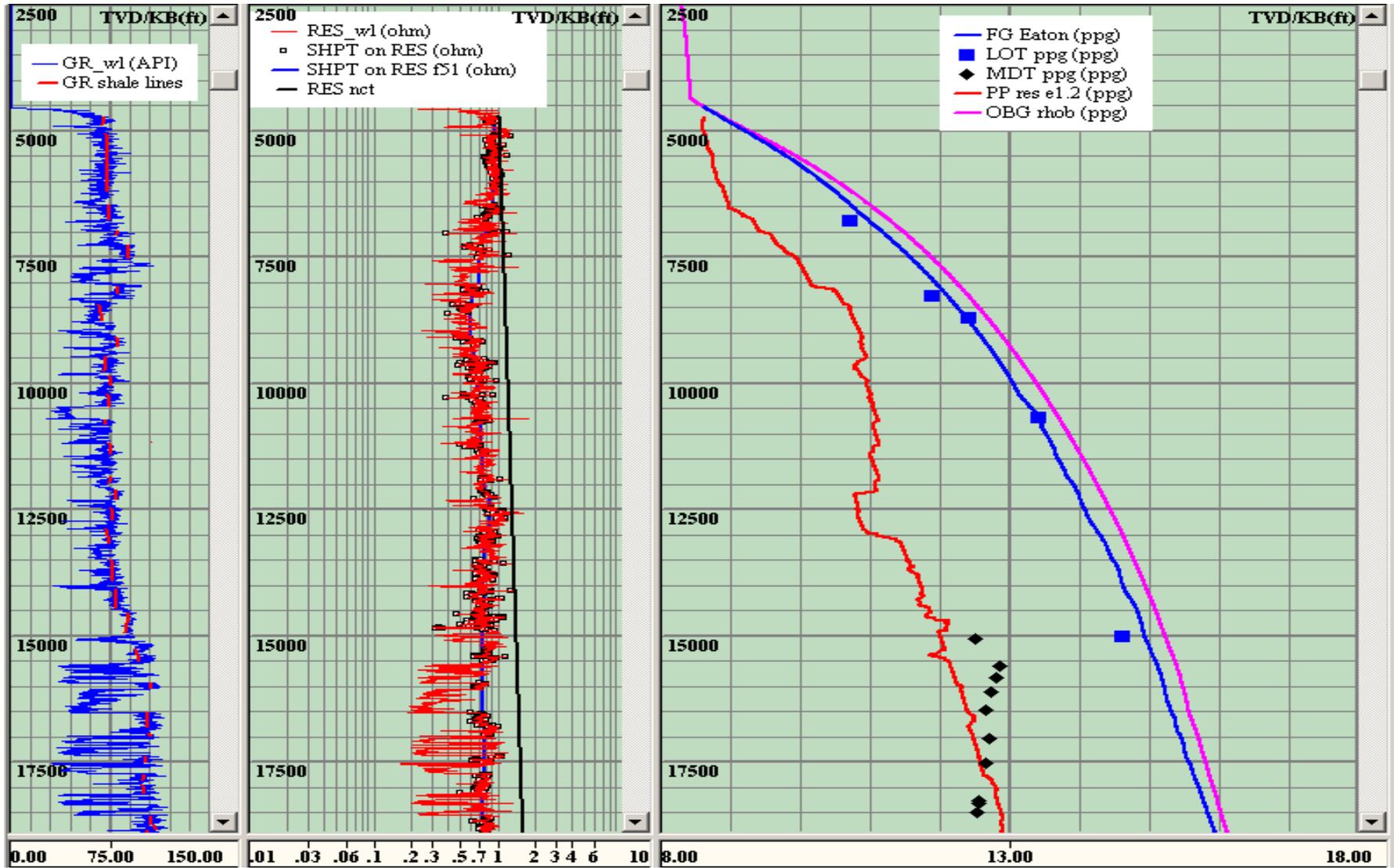


Continue pumping to extend fractures



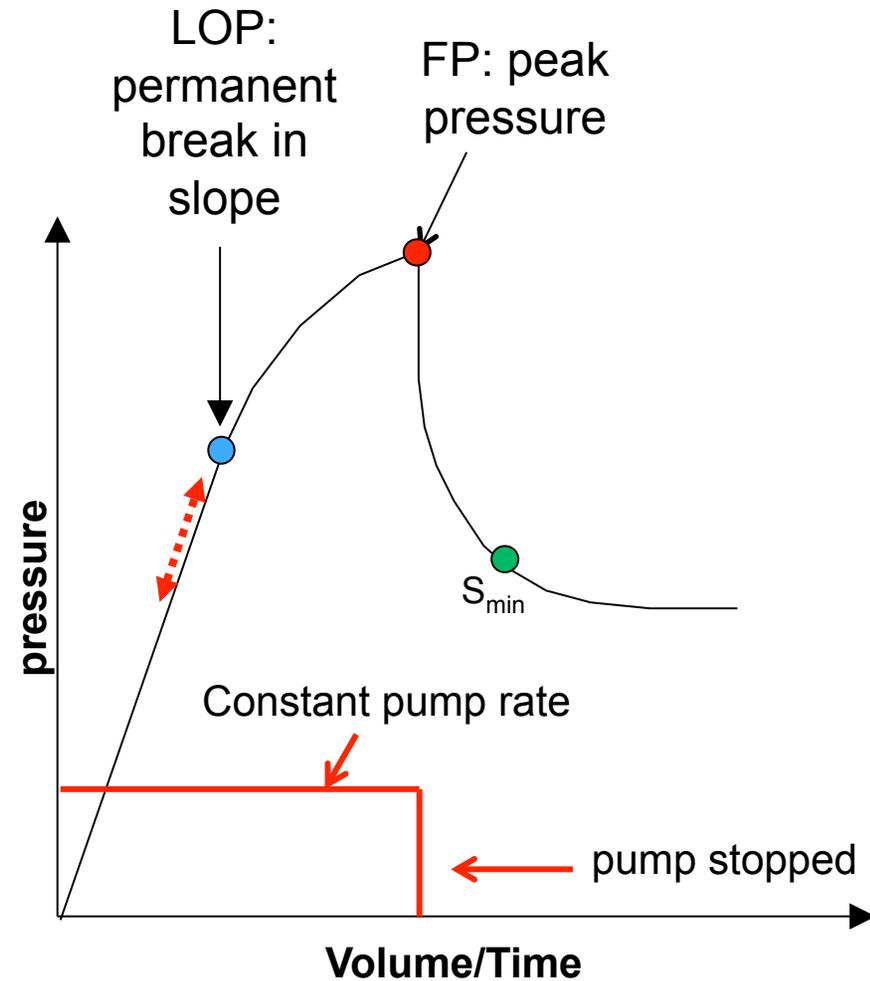
Continue back fracturing using a packer to isolate end sections





Fracture Determination

The pressure at which we either open a pre-existing fracture (LOP) or where we generate a new-hydraulic fracture, i.e. frac the formation (FP)



Volume injected during propagation is equal to average volume of fracture over the interval

Not

Lengths (3D), frequency, or width

Our team found that methane was 17 times higher, on average, in water wells located within a kilometer of active drilling sites, with some of the concentrations dangerously high.

Methane is not benign. It's flammable and poses a risk of explosion. In very high concentrations, it can cause asphyxiation.

However, there's been little research on its health effects in drinking water, and the federal government doesn't regulate it as a contaminant in public water systems.

Read more:

<http://www.newsobserver.com/2011/05/12/1191856/hydrofrackings-methane-issue.html#ixzz1RKamRORP>

Duke Today

The study found **no** evidence of contamination from chemical-laden fracking fluids, which are injected into gas wells to help break up shale deposits, or from "produced water," wastewater that is extracted back out of the wells after the shale has been fractured

"We found measurable amounts of methane in 85 percent of the samples, but levels were 17 times higher on average in wells located within a kilometer of active hydrofracking sites," says Stephen Osborn, postdoctoral research associate at Duke's Nicholas School of the Environment. The contamination was observed primarily in Bradford and Susquehanna counties in Pennsylvania.

The Western Experience

Behind the scenes of the

HORROR

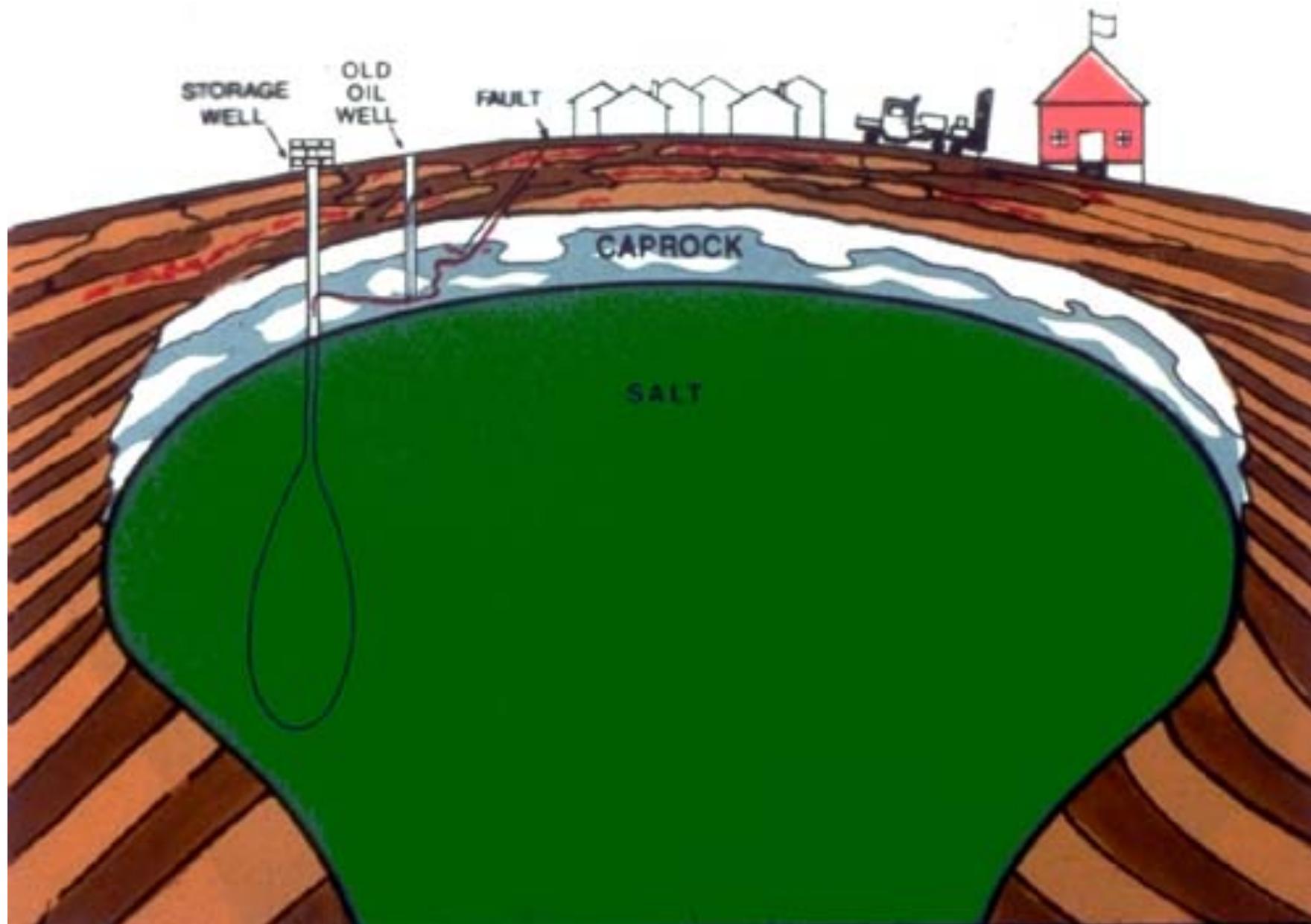
stories the news vendors like

1 Methane in Water

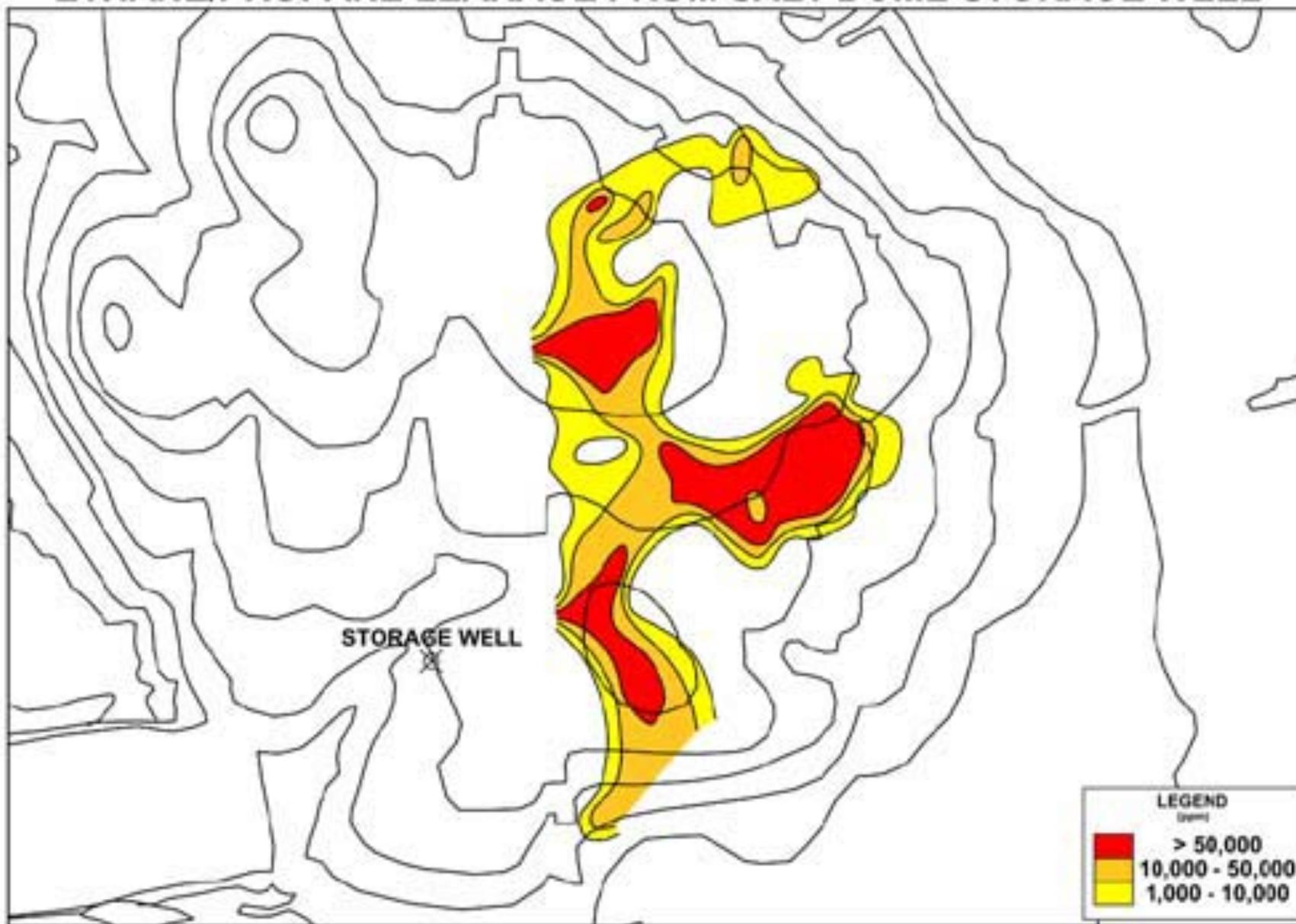
2 Salt Water Spill





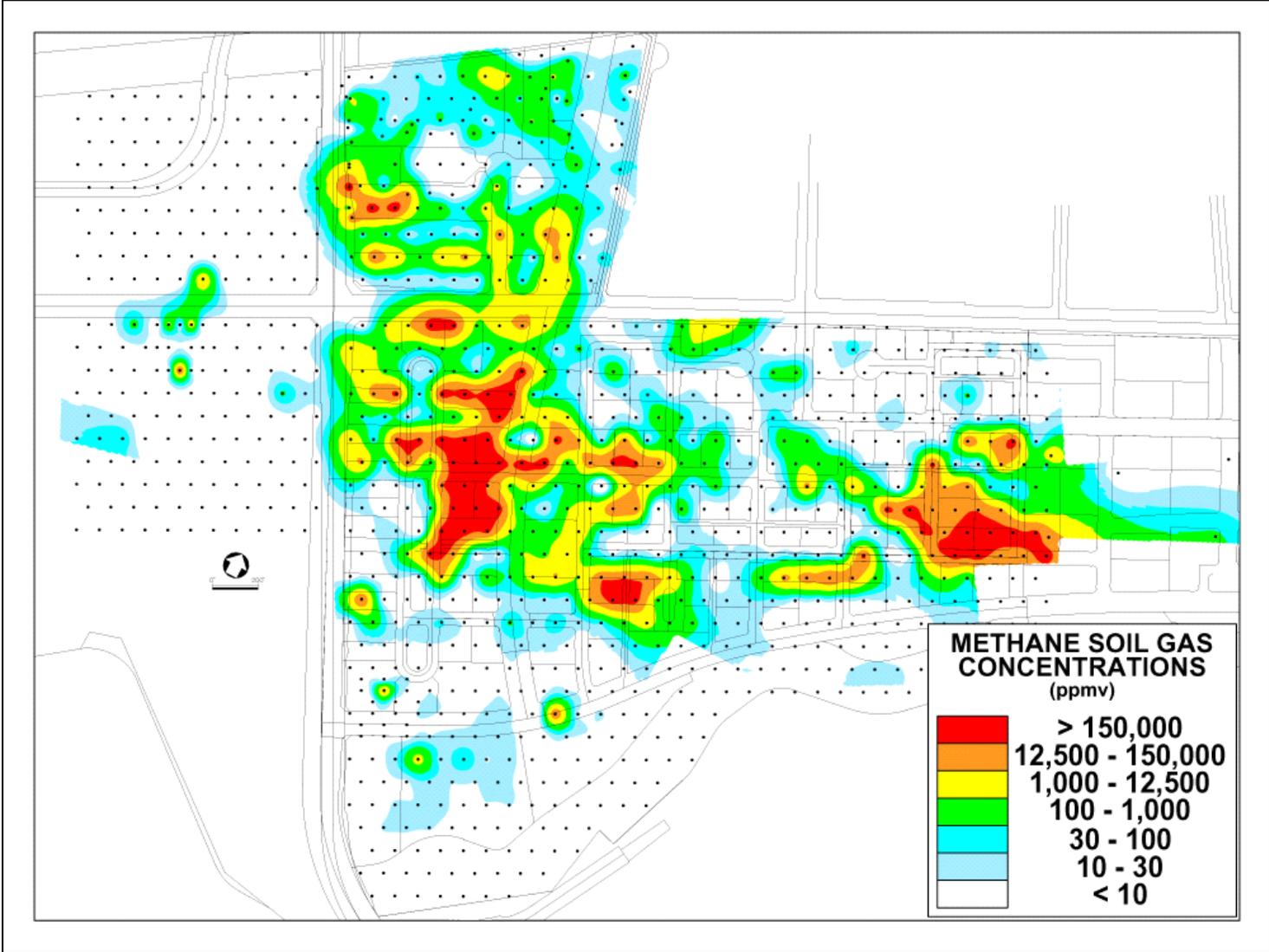


ETHANE/PROPANE LEAKAGE FROM SALT DOME STORAGE WELL



Natural Gas Seepage





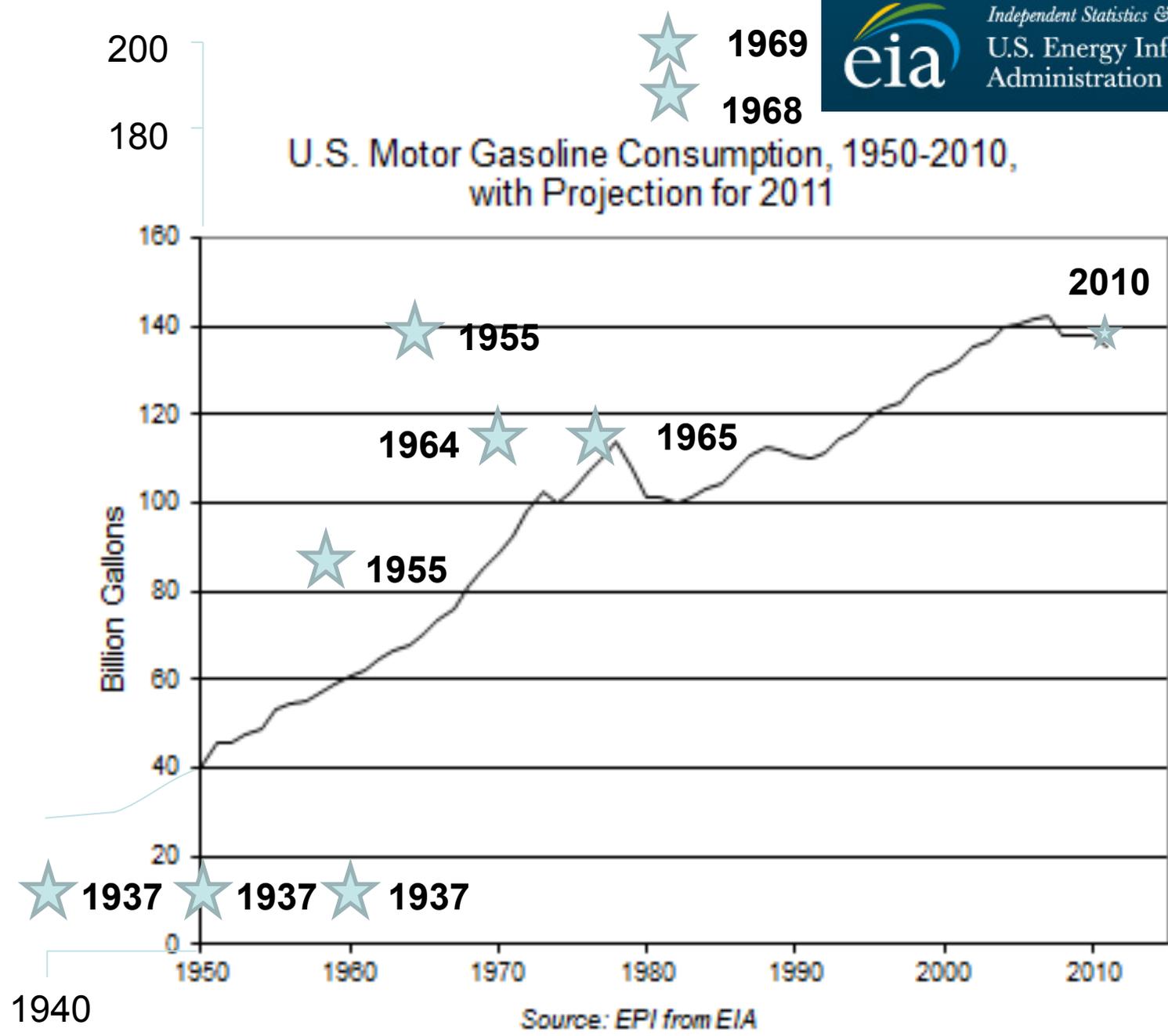
RESERVES ARE LIKE FISH

POSSIBLE: There is water in the lake. Someone may have told you there are fish in the lake. You have your boat on the trailer but you may go play golf instead.

PROBABLE: There are fish in the lake. You may have caught some yesterday. You may even be able to see them, but you have not caught any today. **N.C Tr. Basin**

RESOURCES - PROVED UNDEVELOPED: The fish is on your hook in the water by the boat and you are ready to net him. You can tell how big he looks (they always look bigger in the water).

RESERVES - PROVED DEVELOPED: The fish is in the boat. You have weighed him. You can smell him and you will eat him.



Earth Policy Institute - www.earth-policy.org

Table 3. Principal shale gas plays: natural gas production and proved reserves, 2008-2010

billion cubic feet at 14.73 psia and 60 degrees Fahrenheit

Shale Play	2008		2009		2010		Change 2010-2009	
	Production	Reserves	Production	Reserves	Production	Reserves	Production	Reserves
Barnett	1,501	22,492	1,745	26,493	1,918	31,040	173	4,547
Haynesville/Bossier	25	1,031	321	10,468	1,415	24,451	1,130	13,983
Fayetteville	279	3,833	527	9,070	794	12,526	267	3,456
Woodford	168	3,845	249	6,389	403	9,670	154	3,281
Marcellus	2	102	76	4,478	476	13,199	400	8,721
Antrim	122	2,894	132	2,499	120	2,306	-12	-193
Subtotal	2,097	34,197	3,050	59,397	5,126	93,192	2,112	33,795
Other Shale Plays	19	231	60	1,247	174	4,257	114	3,010
All U.S. Shale Plays	2,116	34,428	3,110	60,644	5,336	97,449	2,226	36,805

**NC Triassic basins 2,000 billion cubic feet
less than 1 percent of 273,000 billion cubic feet of
the nation's proven gas reserves, 6% of shale
plays**

assistant state geologist Kenneth Taylor

What can the landowner do?

- Get a before drilling base line
 - Surface geochemistry samples
 - Water samples
- Get copies of their maps and drilling plans
- Try to assure your aquifer is cased off and cemented
- It is possible that your leakage is due to drilling in your downdip neighbors property

If you own the land rites

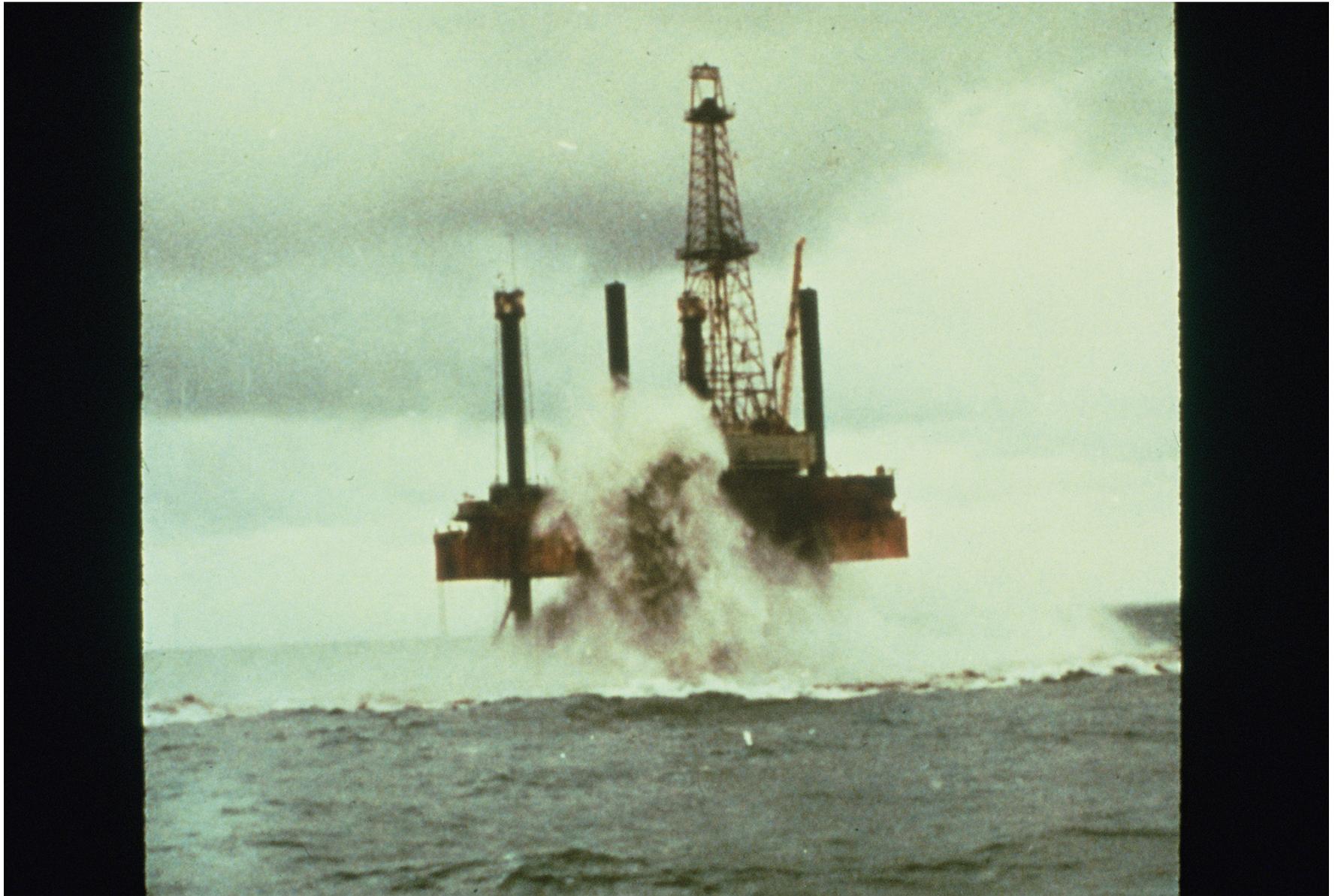
surface and/or subsurface

You can always
influence the deal

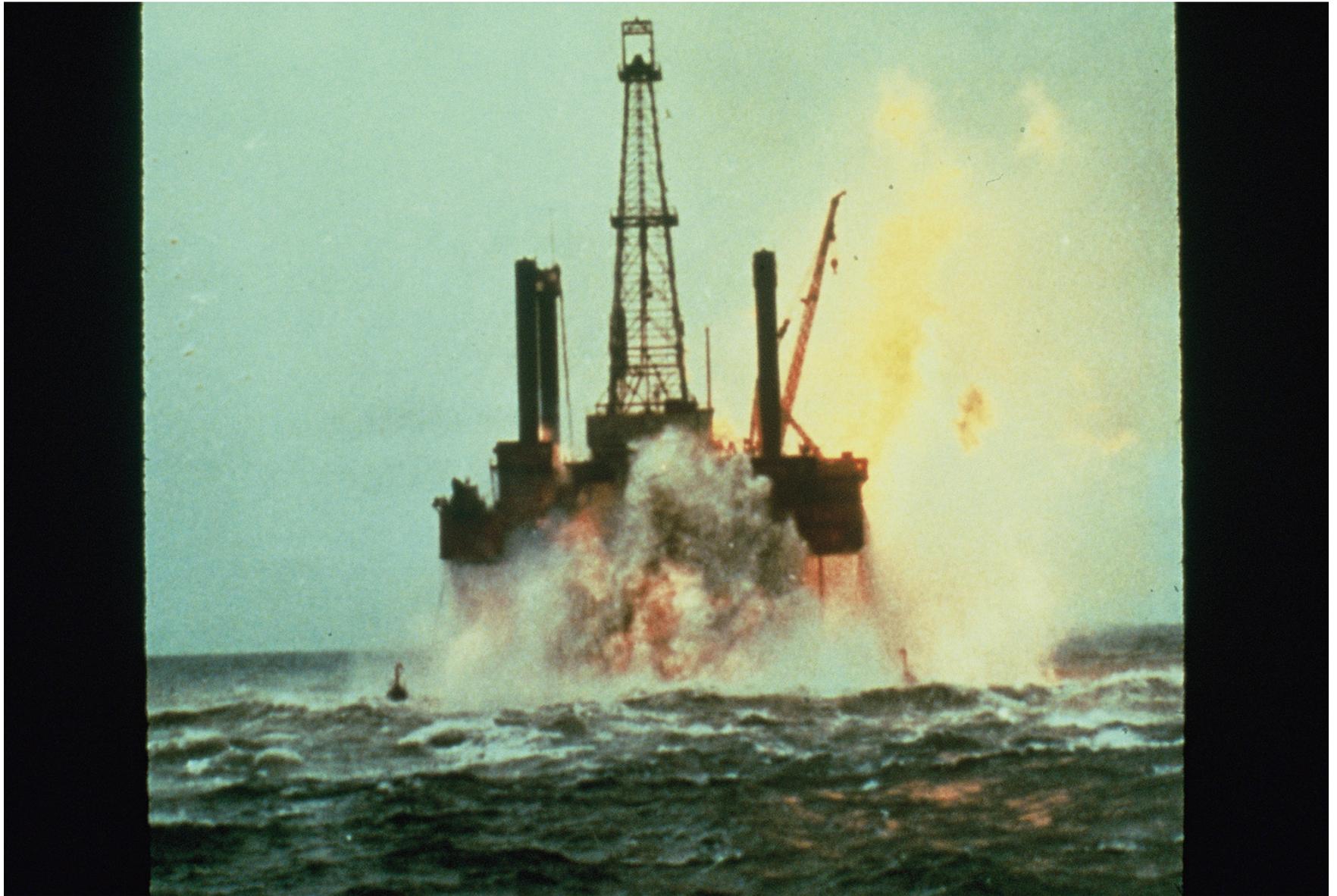
Who Cares about Subsurface Gas?

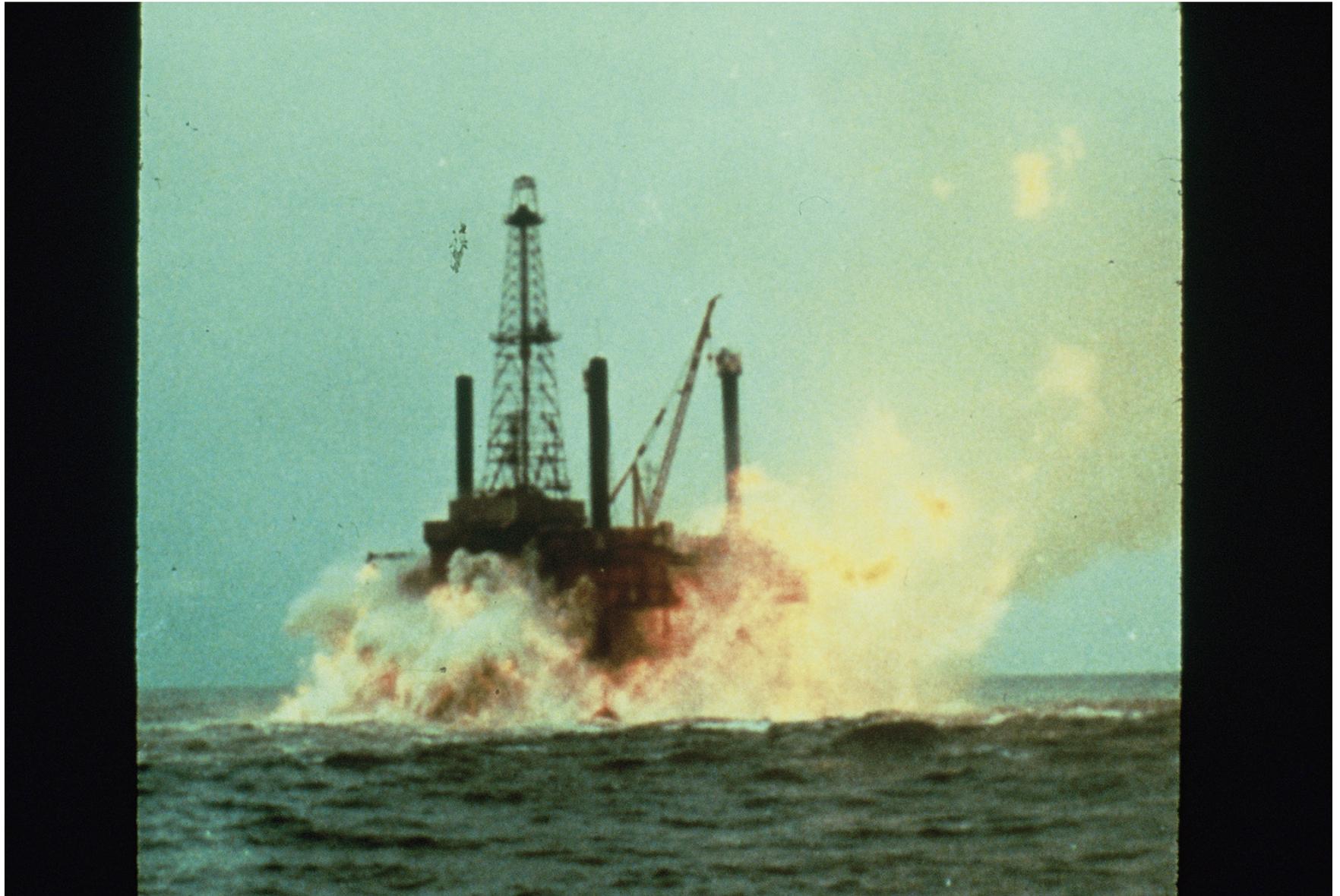


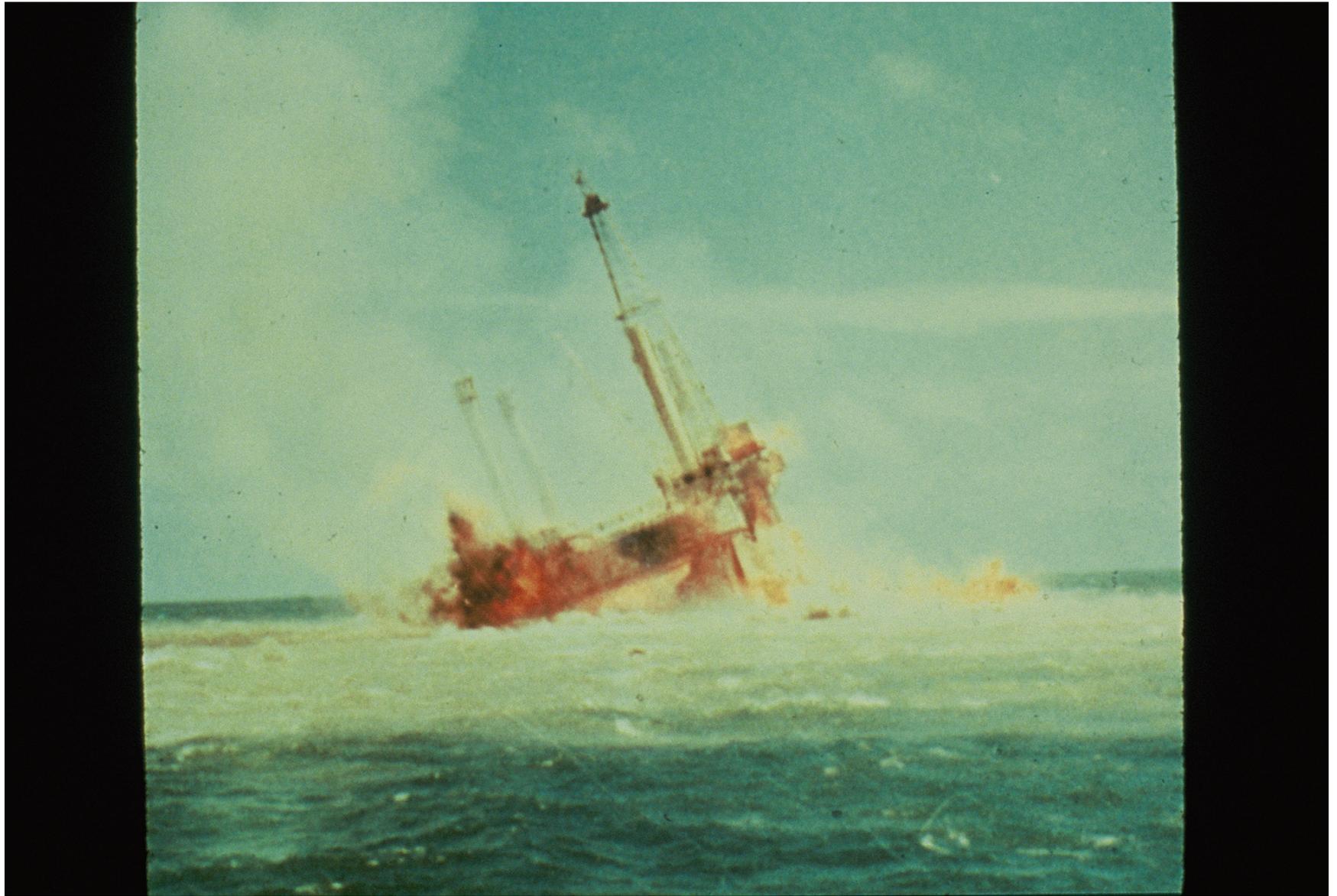




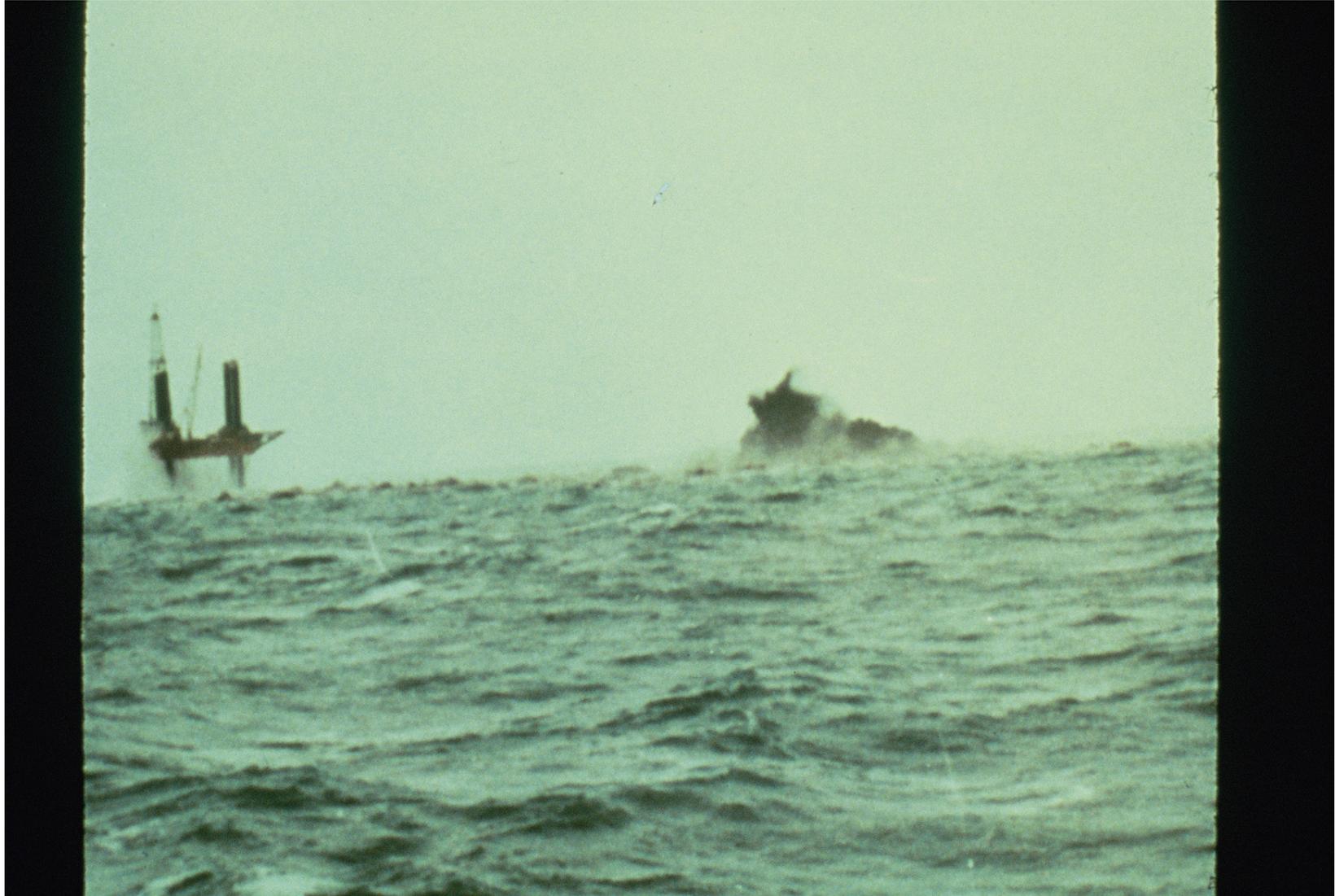








EVERYONE



How did this Happen?

