



Natural Gas STAR Annual Implementation Workshop 2014

**Activities that advance methane recovery and use
as a clean energy source in the oil and gas industry
of Ecuador**

**Jorge Duque-Rivera, ESPOL-Ecuador
San Antonio Texas May 12-14**

OVERALL GOAL OF PROJECT*

- To identify and reduce barriers for fugitive methane recovery and use in the oil and gas industry in Ecuador through capacity building, a pilot study, and systematization of lessons learned from the project.

*Project Funded under EPA Agreement #XA-83397101

Specific objectives

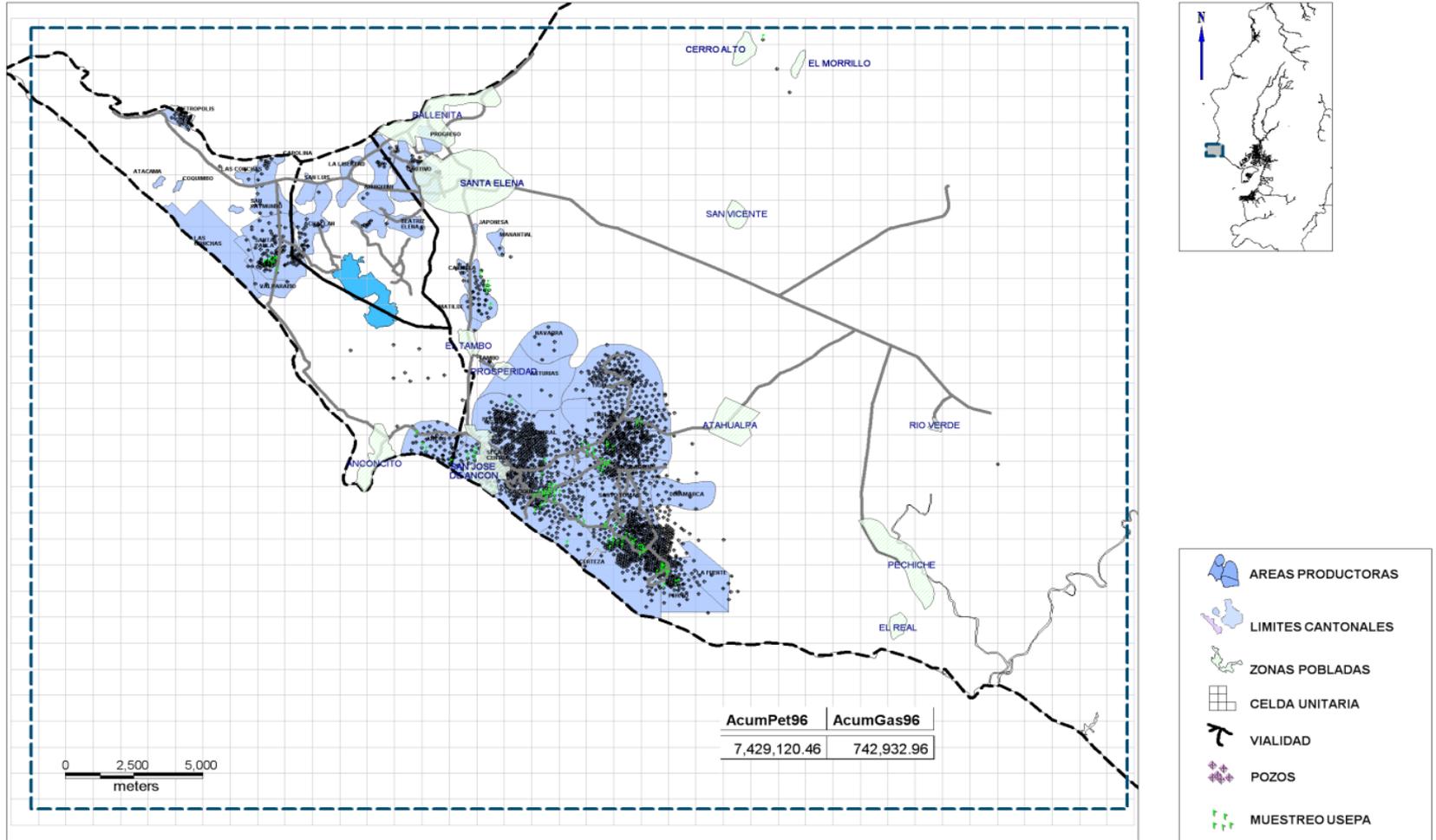
- To conduct an inventory and measurements to determine the quantity and quality of the gas being currently vented at the Ancon oilfield,
- To develop a GIS based decision support system to assist in the selection of recovery and use options,
- To identify schemes to maximize gas recovery,
- To identify legal barriers for the implementation of gas capture and use in Ecuador.
- To complete a pre-feasibility analysis for the use of the recovered methane, and
- Conduct training in Ecuador

Pilot study

- Ancon oil field. A Marginal declining field.
- Approximately 2800 wells, of which 1000 to 1500 wells are abandoned or suspended from operation (depending on the season). The latter group was the main focus of the project.
- Oil production of around 1400 barrels/day in the field. Avg. production 1 barrel/day/well

PLANO GENERAL PROYECTO USEPA-ESPOL

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General view project area

J. Duque-Rivera, Espol, May 2024

Pilot study

- To identify technological and economic methane reduction options for improving capture and use of well casinghead gas.
- In this study wells and storage tanks were targeted for evaluation as other unit operations had already been refurbished.



Training and monitoring of wells and storage tanks

Pilot study

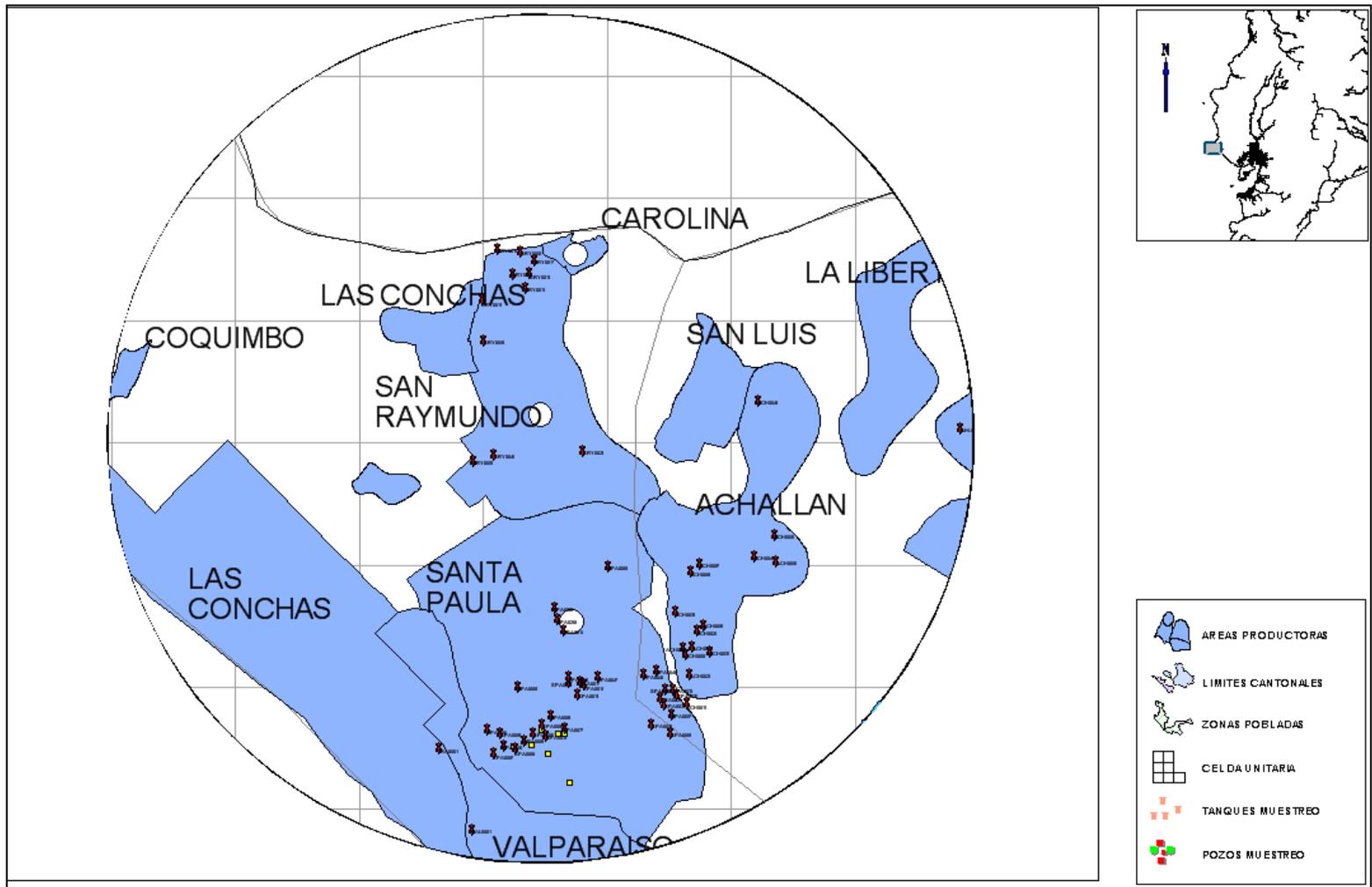
- A total of 100 wells were measured using a High-Flow sampler, including productive wells, wells temporarily suspended from production and abandoned wells. The sampled volume of fugitive methane gas totals 27,065 standard cubic feet (scf) per day, averaging 270 scf per day per well, with a standard deviation of 190 scf per day. This value indicates the wide variation of emissions levels among sampled wells, spanning from zero to 648 scf per day.

Options analyzed

- Three cases were studied based on methane gas collection through a piping network from orphan wells, including storage tanks, compressor stations, production stations and other facilities. These are:
- Establish a distribution of piped gas to San Raymundo community households (600 families) , utilizing the recovered methane:
 - Option 1 Gas collected by trucks from approximately 100 wells, clustered by proximity into 10 groups and sent to a treatment
 - Option 2 Recovered gas from 100 wells approximately, clustered as above, is collected by pipeline and conducted to treatment plant. No trucks needed.
- Option 3
 - Construction of about 1200 plug assemblies in different diameters and the plugging of the wells.

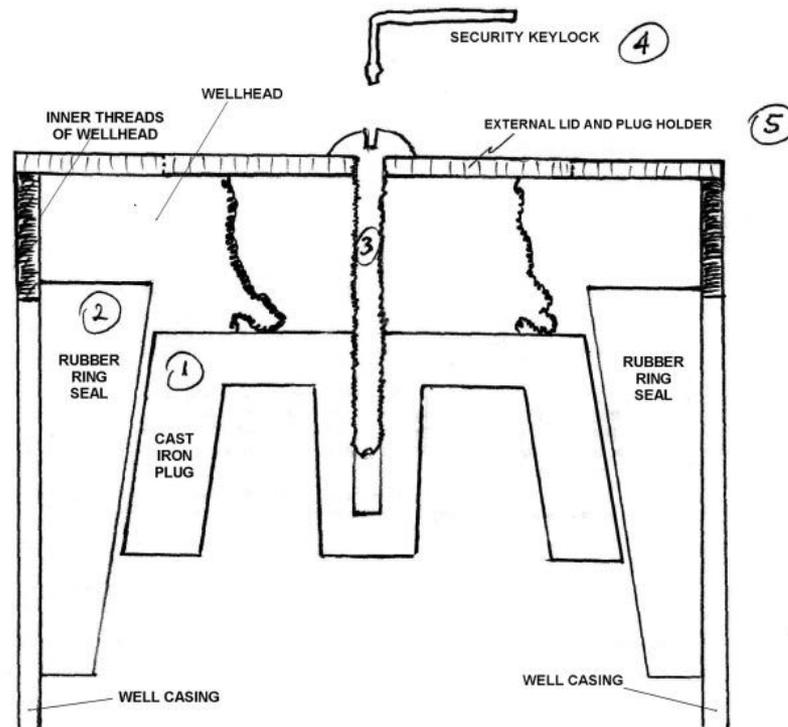
Gas Production of Wells and Interconnecting Piping Lengths

Group	Wells	# Wells	Flow (ft ³ /day)	Piping Length (m)
1	SPA0077, SPA0082, SPA0088, SPA0203, SPA0221, PA0225, SPA0246	7	1714	1297
2	ANC0318, ANC0382, ANC0590, ANC0381, ANC0394, ANC0388	6	806	1226
3	ANC0582, ANC0585, ANC0547, ANC0548, ANC0546, ANC0424, ANC1703, ANC1713	8	3110	2587
4	CMA0021, CMA0006, CMA0020, CMA0026, CMA0024, CMA0038	6	1843	1472
5	ANC0284, ANC0283, ANC0333, ANC0334, ANC0298, ANC0341, ANC0308, ANC0309, ANC0309, ANC0307, ANC0340, ANC0294	11	1814	14396
6	ANC0279, ANC0265, ANC0278, ANC0276, ANC0280, ANC0273, ANC0270	7	1007	3734
7	ANC1109, ANC1353, ANC1117, ANC1360, ANC1104, ANC1076, ANC0988, ANC1132, ANC0986	9	3918	1973
8	ANC1986, ANC0996, ANC1007, ANC1040, ANC2014, ANC1657	6	402	892
9	ANC0441, ANC0439, ANC0440	3	1152	344
10	ANC0025, ANC0024, ANC0002, ANC0026, ANC0012, ANC0015, ANC0017	7	3249	2787
11	SPA0052, SPA0207, SPA0250, SPA0256, VAL0006	5	8333	1980
	TOTAL	76	27348	32688



San Raymundo and Santa Paula (North region)





Espol Plug proposal (completing patent application)

Economic analysis of options

- Analysis included investment and operating costs
- Options 1 and 2 considered:
 - Income from the sale of gas to households,
 - Savings of government for avoided subsidies of the LPG currently consumed in households
 - Income from Emission Reductions

Summary Results

	Option 1	Option 2	Option 3
Initial Investment required (US\$)	5,087,945	8,427,945	1,200,000
Revenue expected per year (US\$)	140,312	140,312	63,760
Financial IRR calculated at current prices	-1.37%	-3.67%	3.17%
NPV at current prices	-\$ 2,461,265	-\$ 5,643,985	\$ 25,958
Benefit-cost ratio	0.53	0.34	1.02
Investment recovery period (years)	No	No	20.4

Recommended option to be executed as a first priority is the plugging of approximately 1200 opened-to-air abandoned or suspended oil wells in the Ancon oilfield (**option 3**).

- It is technically feasible.
- The costs are reasonable.
- The returns on investment and capital, IRR and NPV are acceptable.
- Represents a source of skilled labour since plugs are national made.
- Prevents the emission of greenhouse-effect gases in the atmosphere.
- Does not require an administration unit.

Second priority would be Option 1. Although this solution is not financially appropriate, it could also be done on social grounds

Limitations

Measurements were taken at well heads, and even though they may not have fulfilled all the requirements of a more rigorous approach, they do point out the presence of fugitive methane gas from the abandoned and/or open well heads and some other related infrastructure.

The measurements do give a quantitative idea of the volumes of fugitive gas involved.

Participating personnel

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- **Ivan Apolo, GIS**
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- **José Carlozama, Industrial Engineer, Field Work**
- **Roberto Saenz O., Sociologist/Demographer**

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