Salem, Nevine

From: Rachel Pappworth <rpappworth@ses-inc.net>
Sent: Friday, September 26, 2014 11:29 AM
To: Salem, Nevine
Cc: Alison Doyle
Subject: RE: Updates
Attachments: Preliminary Estimate of Number of Wells.docx

Dear Nevine:

Got it.

As you are aware, the number of wells needed to inject a certain volume of a particular material into a reservoir is dependent on a number of factors including:

- The permeability and porosity of the formation
- The thickness of the formation to be injected into and associated pressures
- The nature and volume of the material being injected and the compatibility of this material with the formation

You can, and do, get large differences in the number of wells needed to inject even similar volumes and types of materials depending on the specific nature and conditions of the formations.

The purpose of the detailed site screening and analysis study of the reservoir is to answer these questions and to determine the exact number and location of the injection wells.

For this project four reservoirs that had historically had CO_2 flood projects in the area around the Ramsey plant were looked at to come up with a preliminary estimate of the wells used.

I have attached a copy of a summary of this review, which includes some historic information on the reservoirs etc.

The following excerpt shows how we came up with the 27 wells:

Number of wells needed for injection:
To inject the 10.83 MMSCF/D a number of wells will be needed. To find that, assuming CO_2 storage in one of the four fields, we assumed the Ford Geraldine field average well. At the highest level we needed 69 wells to inject 20-25 MMSCF/D. Therefore:
The CO_2 rate per injection well= 23000/69 = 334 MSCF/D.
This then means that the injection rate per well in the four Delaware basin fields is in range of 400 MSCF/D.
Taking that total CO_2 injection rate in the four fields are as follows:

Reservoir	# Injection wells	# Producing wells	total CO_2 MMSCF/D
Two Freds	9	32	3.6
Elmar	20	16	8.0
E.Ford	4	8	3.2
FordGeraldine	69	92	23.0 -27.5

These total rates are representative of the total CO_2 injected. So assuming we clean the injection wells in the field selected to inject 10.83 MMSCF/d of CO_2 we will need:
No. of wells = 10830/400 = 27 wells.

PLEASE NOTE: WE DID NOT INCLUDE MONITORING WELLS IN THE CALCULATIONS

Let me know if you need anything else.

Have a great week-end.

Rachel

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From: Salem, Nevine [mailto:Salem.Nevine@epa.gov]
Sent: Friday, September 26, 2014 10:22 AM
To: Rachel Pappworth
Cc: Alison Doyle
Subject: RE: Updates

Great thanks. Again it doesn't have to be perfect, just send me what you already have and I will take care of it.

From: Rachel Pappworth [mailto:rpappworth@ses-inc.net]
Sent: Friday, September 26, 2014 10:18 AM
To: Salem, Nevine
Cc: Alison Doyle
Subject: RE: Updates

Thanks. Will do.

I am sending you the injection well information shortly.

Rachel

From: Salem, Nevine [mailto:Salem.Nevine@epa.gov]
Sent: Friday, September 26, 2014 10:03 AM
To: Rachel Pappworth
Cc: Alison Doyle
Subject: RE: Updates

Rachel,

Attached is the latest draft permit that I have. Please have your final review and let me know if you have any edits. I will send you the SOB as soon as it is finalized.

Thanks and have a wonderful Friday.

Nevine Salem
Environmental Engineer
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From: Rachel Pappworth [mailto:rpappworth@ses-inc.net]
Sent: Friday, September 26, 2014 8:38 AM
To: Salem, Nevine
Cc: Alison Doyle
Subject: Re: Updates

Call me on my cell phone anytime!

(713) 443-6085

Rachel

Sent from my iPhone

On Sep 26, 2014, at 8:32 AM, Salem, Nevine <Salem.Nevine@epa.gov> wrote:

> Good morning Rachel,
>
> I just want to give you quick updates. What will be a good time to call you today?
>
> Thanks,
>
> -Nevine