Ex. 5 Deliberative Process (DP)

From: d'Almeida, Carolyn K.
Sent: Thursday, July 07, 2016 11:18 AM
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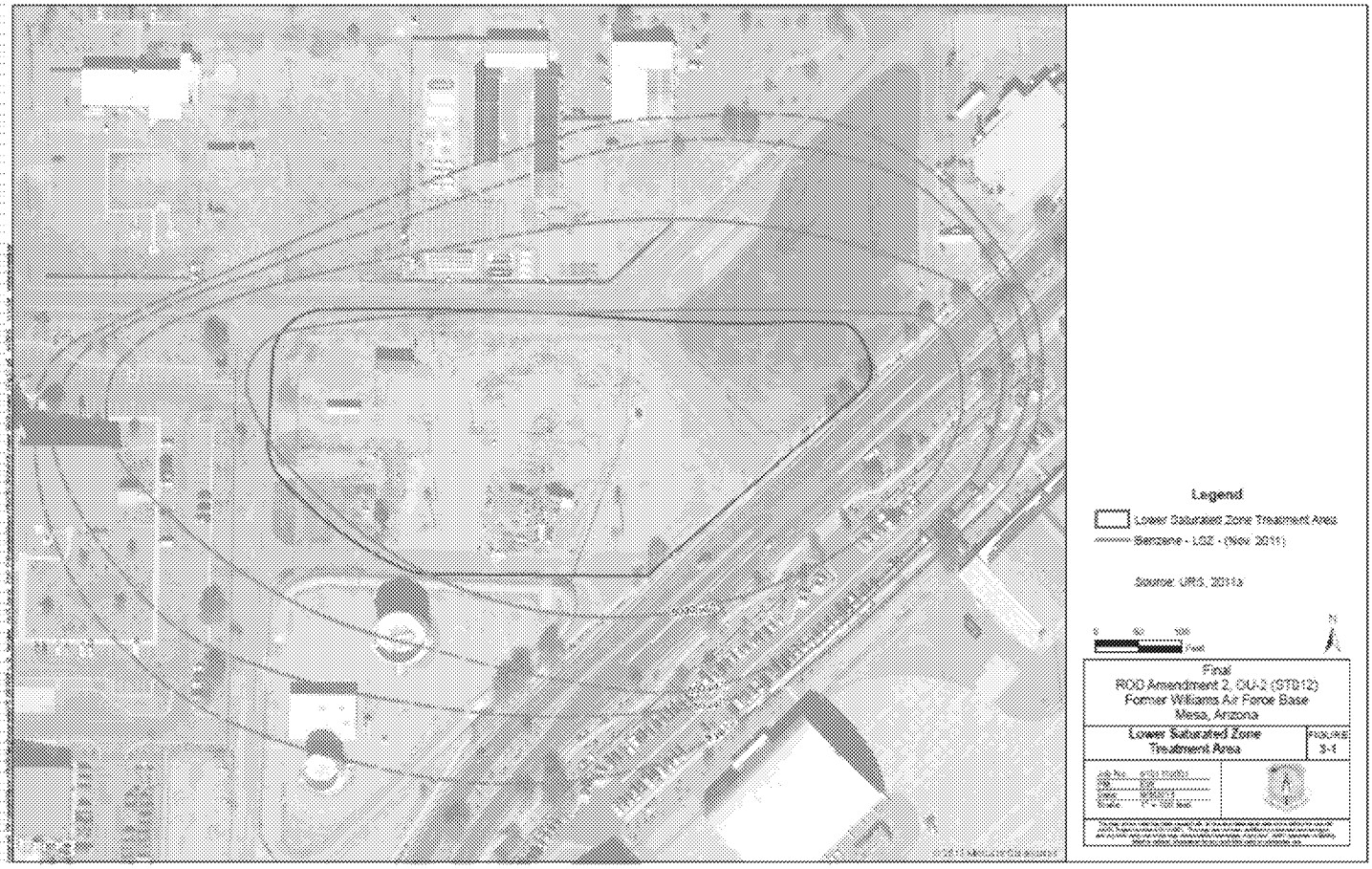
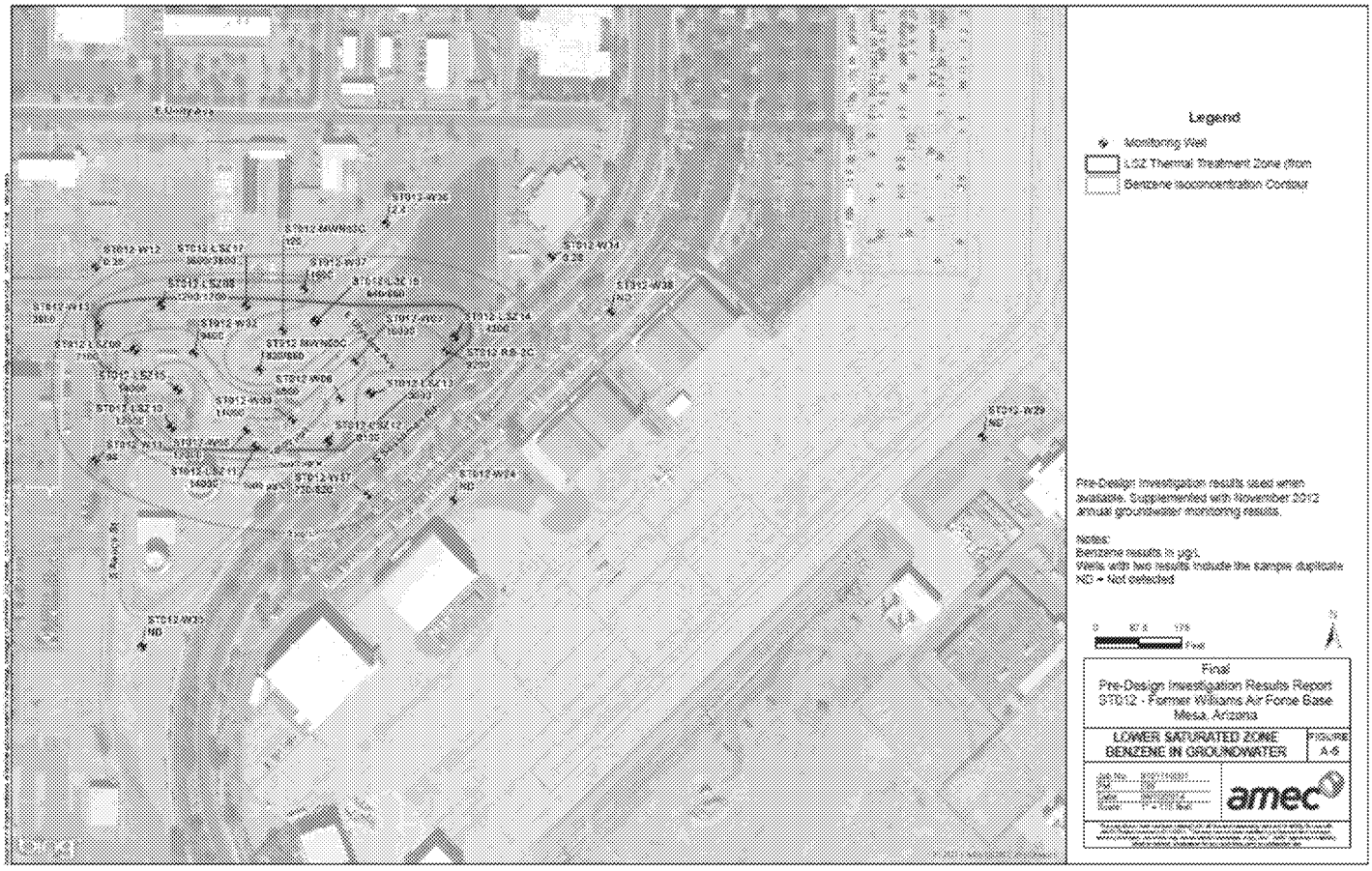
Subject: ST12 groundwater plume contours over time

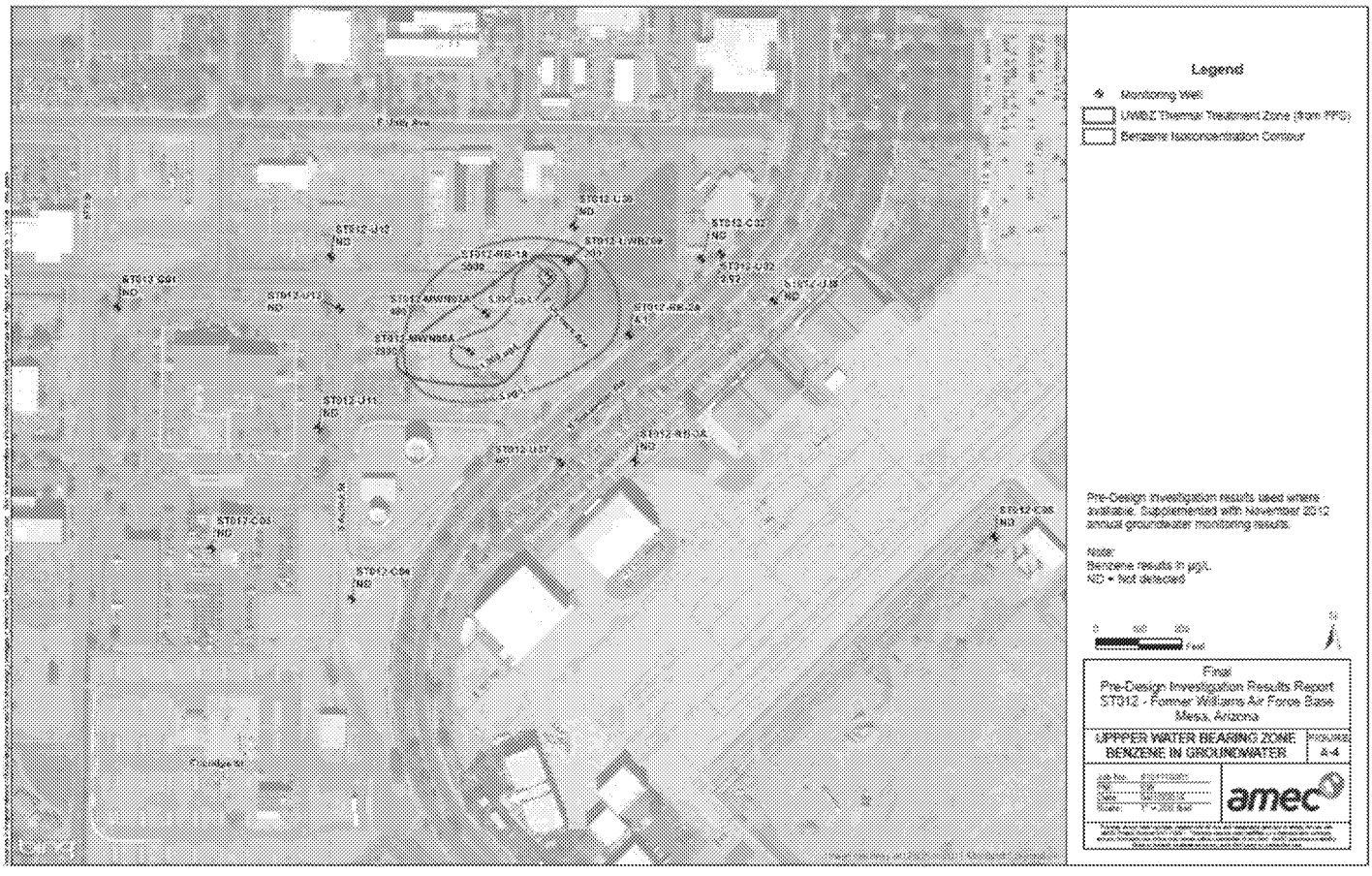
This figure below is from the 2013 ROD amendment - note the extent of the 5000 ppb Benzene contour line



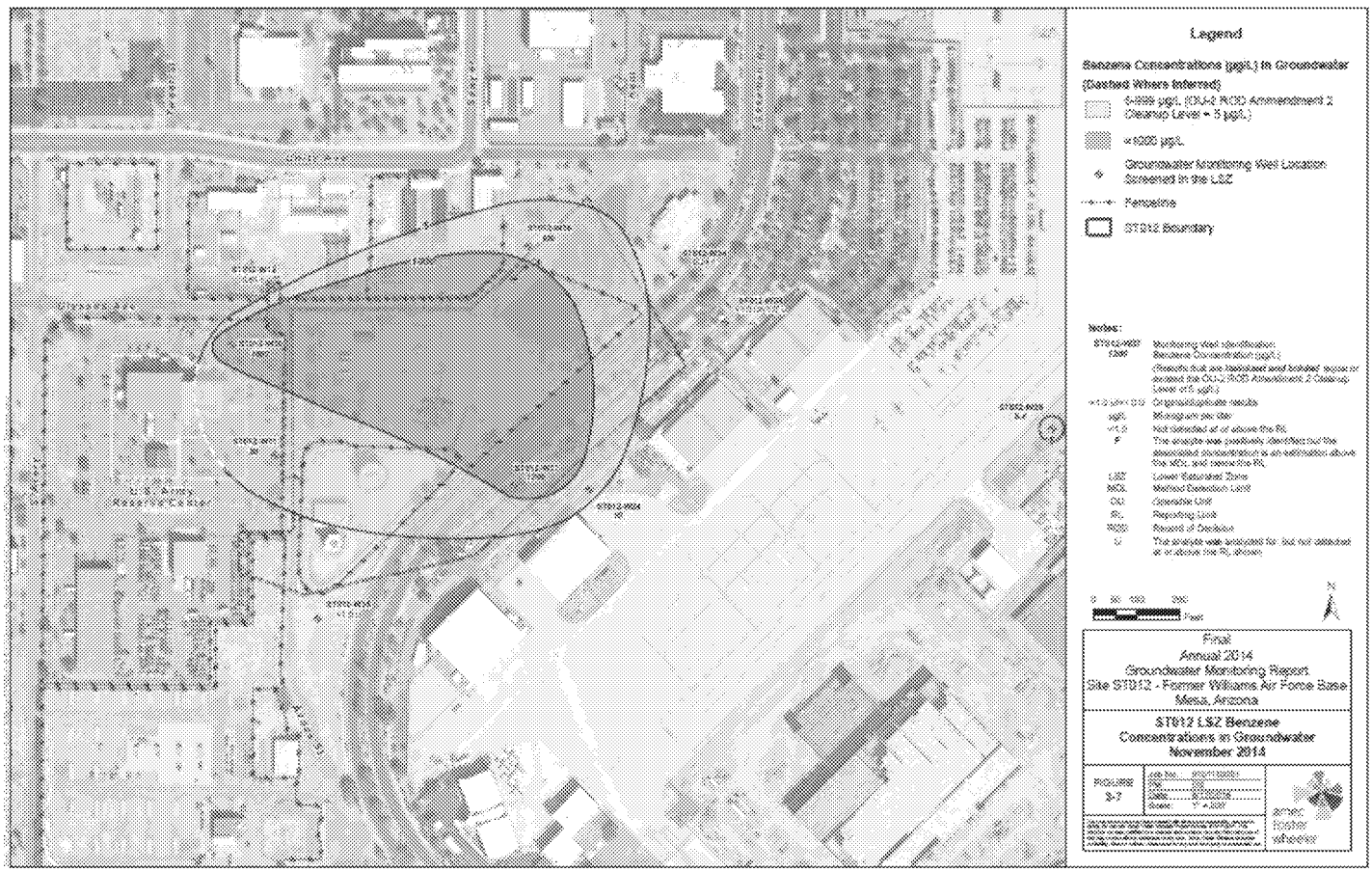
From the RDRA workplan: Note concentrations over 10,000 ppb present – believe this refers to soil cores, LNAPL not dissolved in groundwater



Here is Upper Water bearing zone contours; basis of design for SEE in the Upper Water Bearing Zone

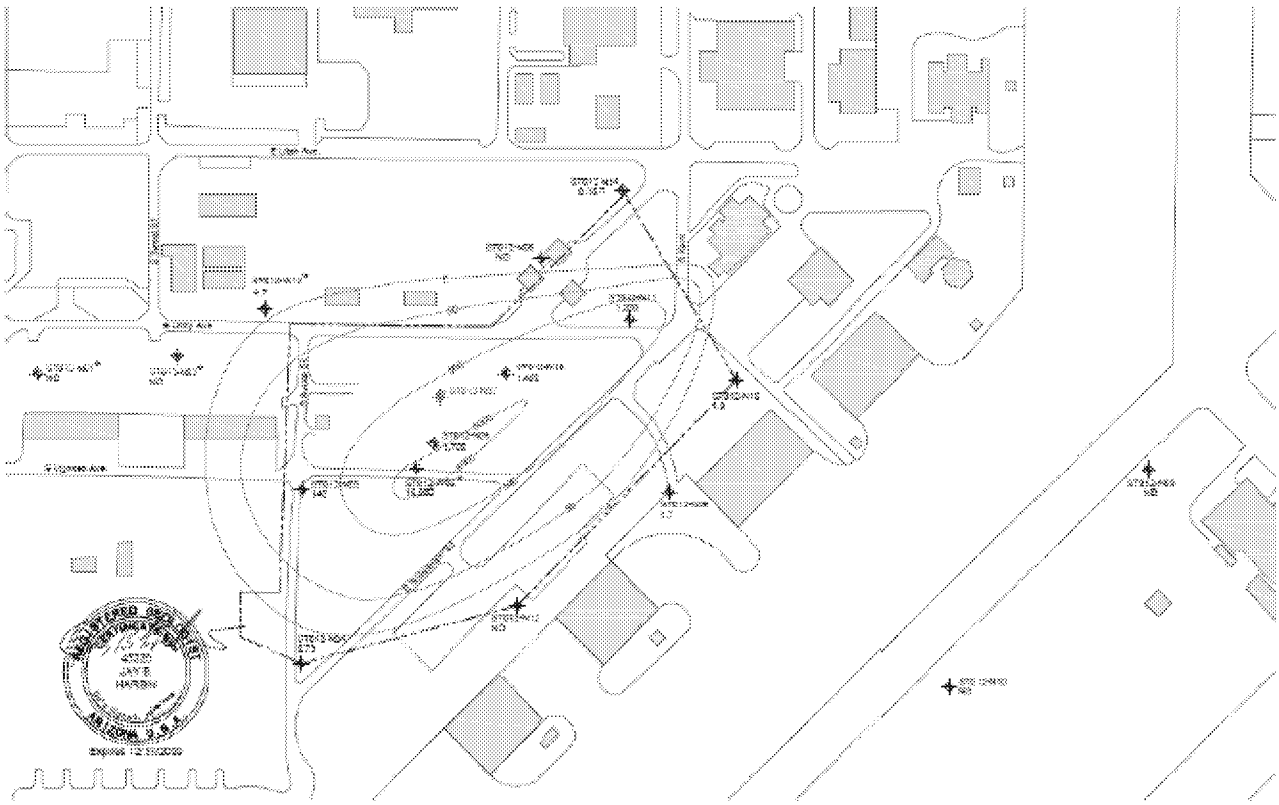


2014 Annual groundwater monitoring report – November 2014 1 month after initiation of SEE - note where 5000 ppb benzene concentration was is now 1000 ppb benzene concentration. Where did all of the benzene go ? Is it volatilizing?



Presented at the June 2016 BCT meeting : 5000 ppb contour is very small area of the site as of Jan 2008 AF has always described the plume as "stable": Did it spread just with the rising water table, or was this an underrepresentation of the actual site conditons? This is dissolved phase benzene before TEE Pilot operation began:

LSZ Benzene Concentrations Jan 2008



Pilot operation schedule:

Step 1: Pre Steam Groundwater/NAPL Extraction 8/11/08 - 10/28/08

Step 2: Mass Transfer Testing (LSZ) 8/26 – 10/27/08; (UWBZ) 8/26 – 8/23/09

Step 3: Steam injection (LSZ) 10/28/-1/26/08; (UWBZ) 11/10 – 2/17 2009

Step 4: Co Steam/Air Injection (LSZ) 1/26 -3/23/09 (UWBZ) 2/17 – 4/8/09 2009

Step 4: Air/ Water Injection (LSZ) 3/24- 5/20/09 (UWBZ) 4/8 -5/20/09

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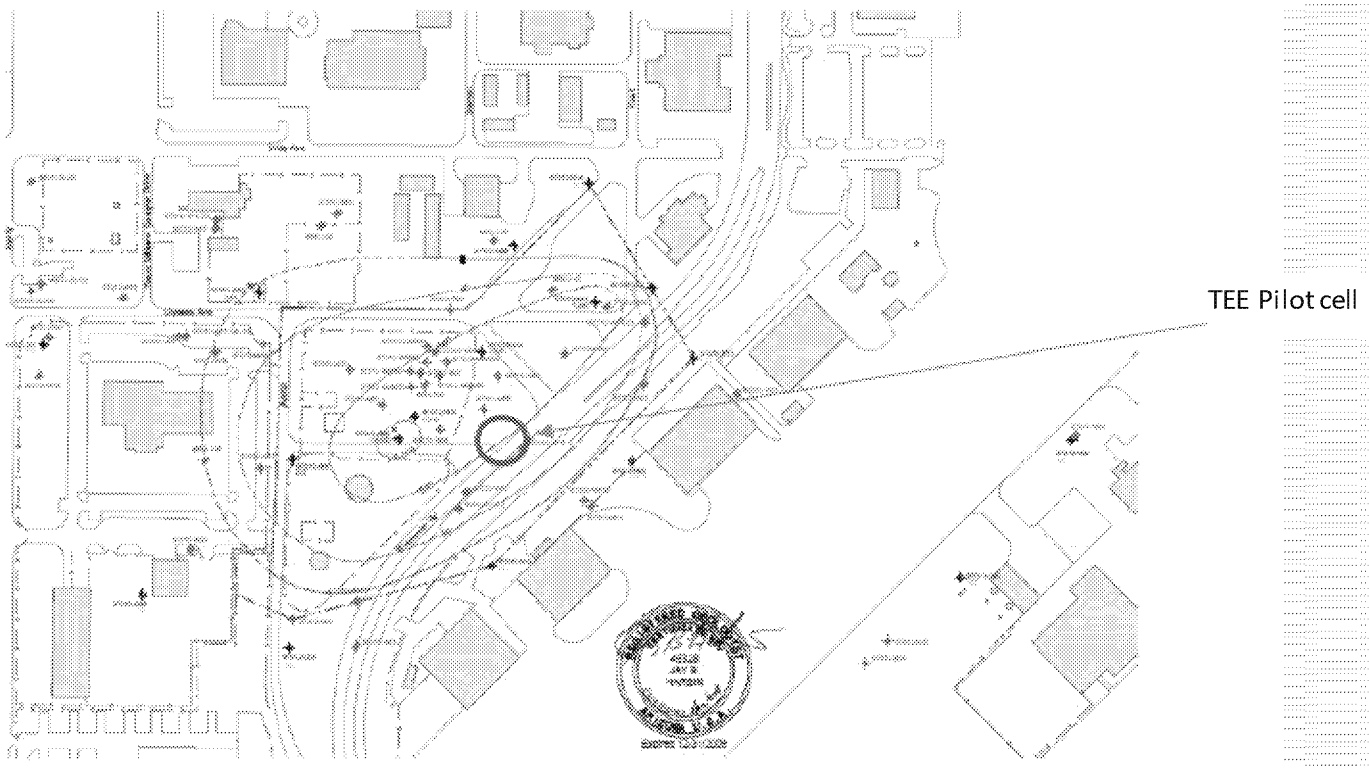
11 Weeks of pre- steam pump and treat & mass transfer tests
17 Weeks of steam injection 13 weeks in LSZ, 14 weeks in UWBZ
10 Weeks of steam and air, 8 weeks in LSZ, 7 weeks in UWBZ
10 weeks of cooling and flooding

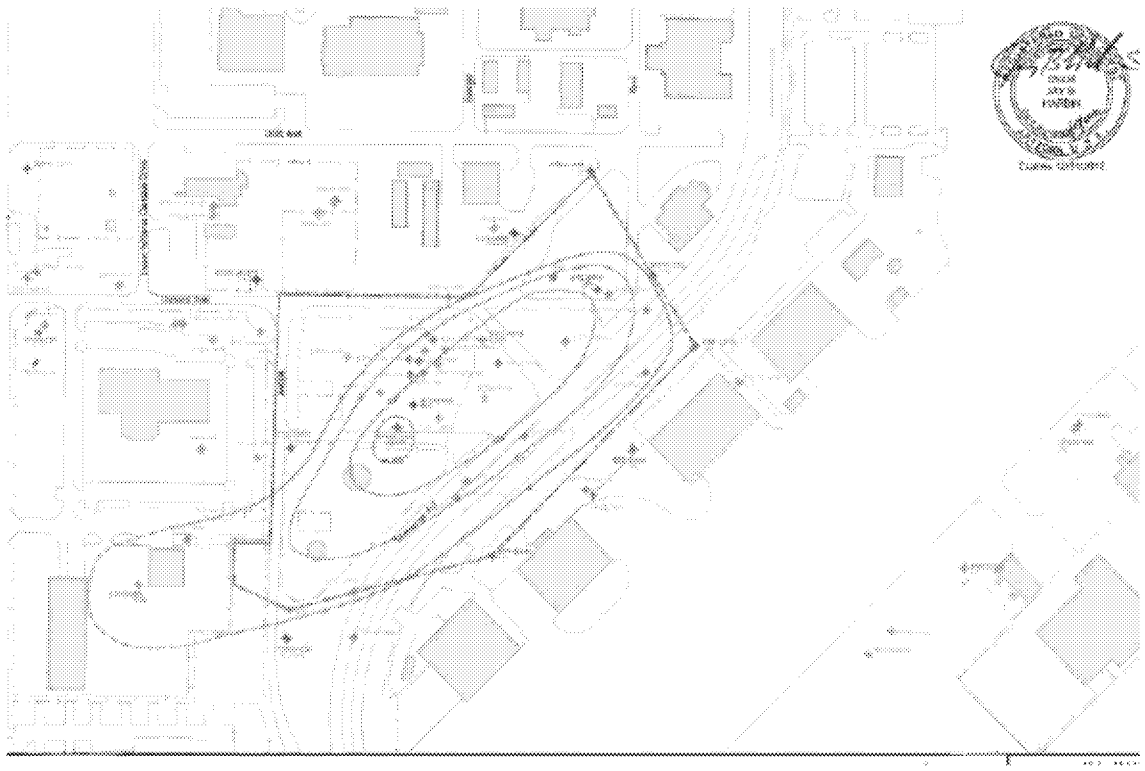
As of Nov 2008 – beginning of steam injection for TEE pilot:

LSZ Benzene Concentrations Nov 2008



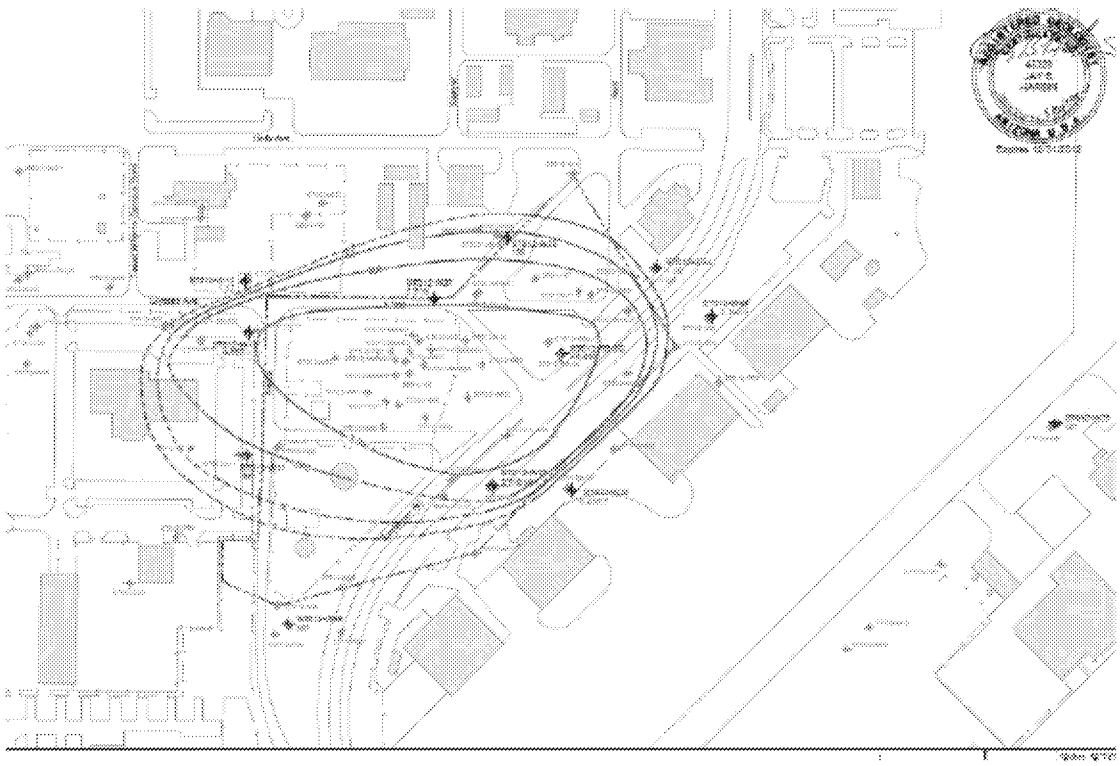
This is the beginning of steam injection into the LSZ just after startup of TEE pilot – note dramatic change in contours

LSZ Benzene Concentrations Nov 2009



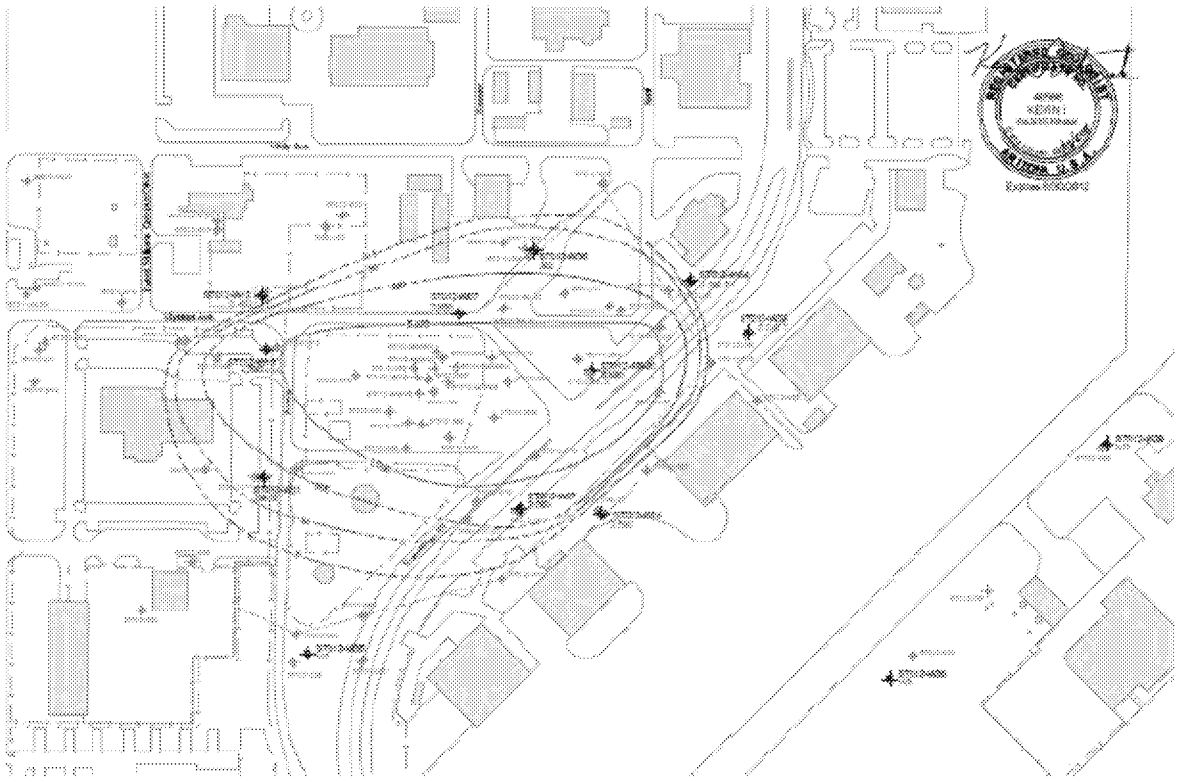
After TEE Pilot: Loss of containment was a concern during TEE because extraction pumps kept going down and weren't repaired/replaced while pilot was operating; steam injection operating without full containment.

LSZ Benzene Concentrations Nov 2010



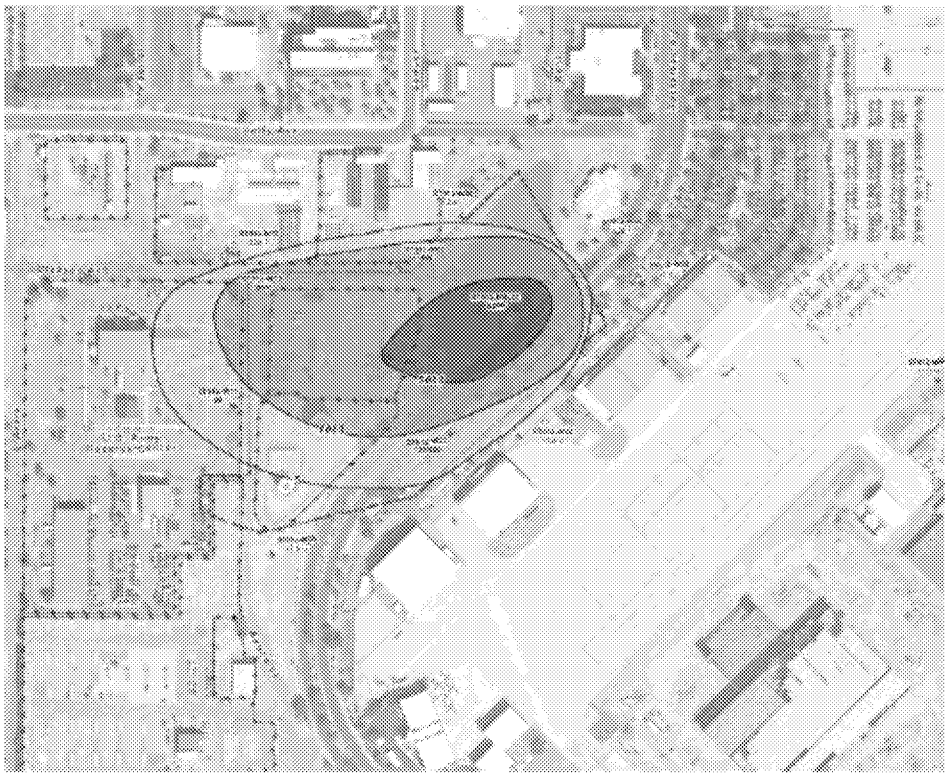
Plume continues to spread – water table now up in highly transmissve cobble zone

LSZ Benzene Concentrations Nov 2011



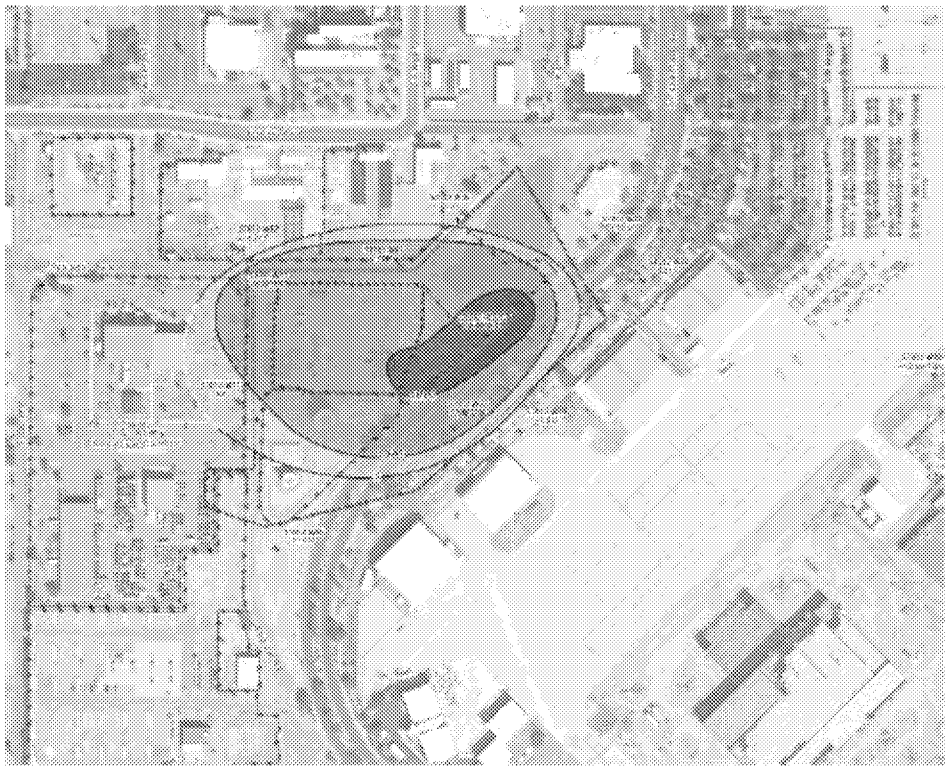
This appears to indicate that the dissolved phase benzene may have moved east of the area that treated by SEE, before SEE system was designed and constructed. At this time AF was pumping TEE pilot wells for containment:

LSZ Benzene Concentrations Nov 2012



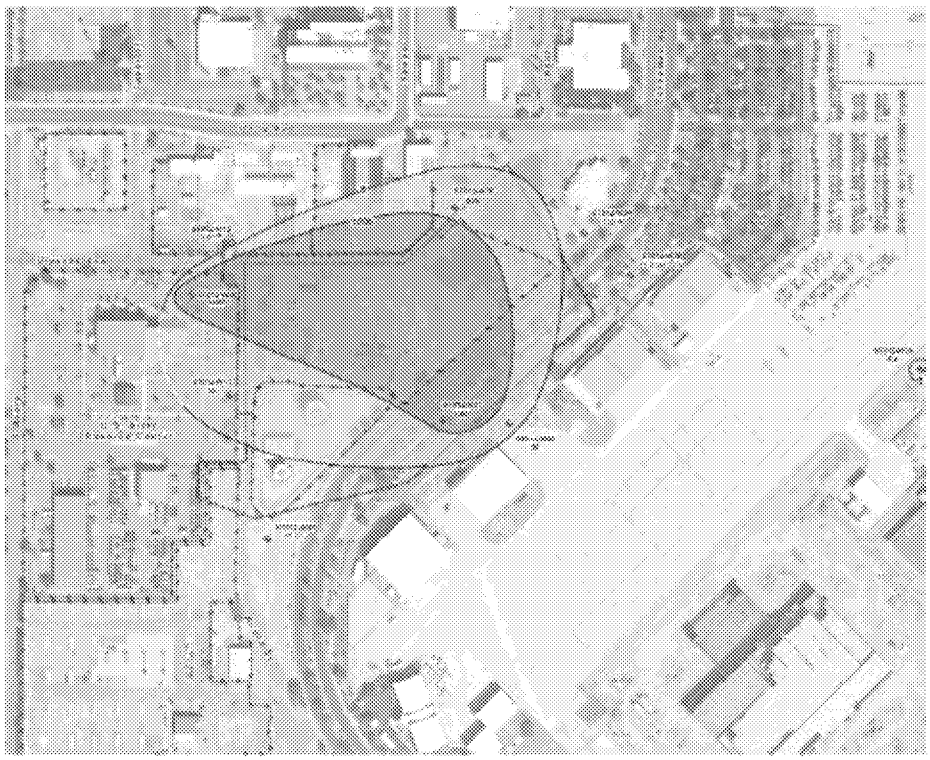
Dissolved phase Benzene as of RODA Signature: These contours are inconsistent with the figure from the RODA (first figure a the top of the page): The 5000 ppb contour below is shown in dark pink Why is dissolved phase plume smaller?

LSZ Benzene Concentrations Nov 2013



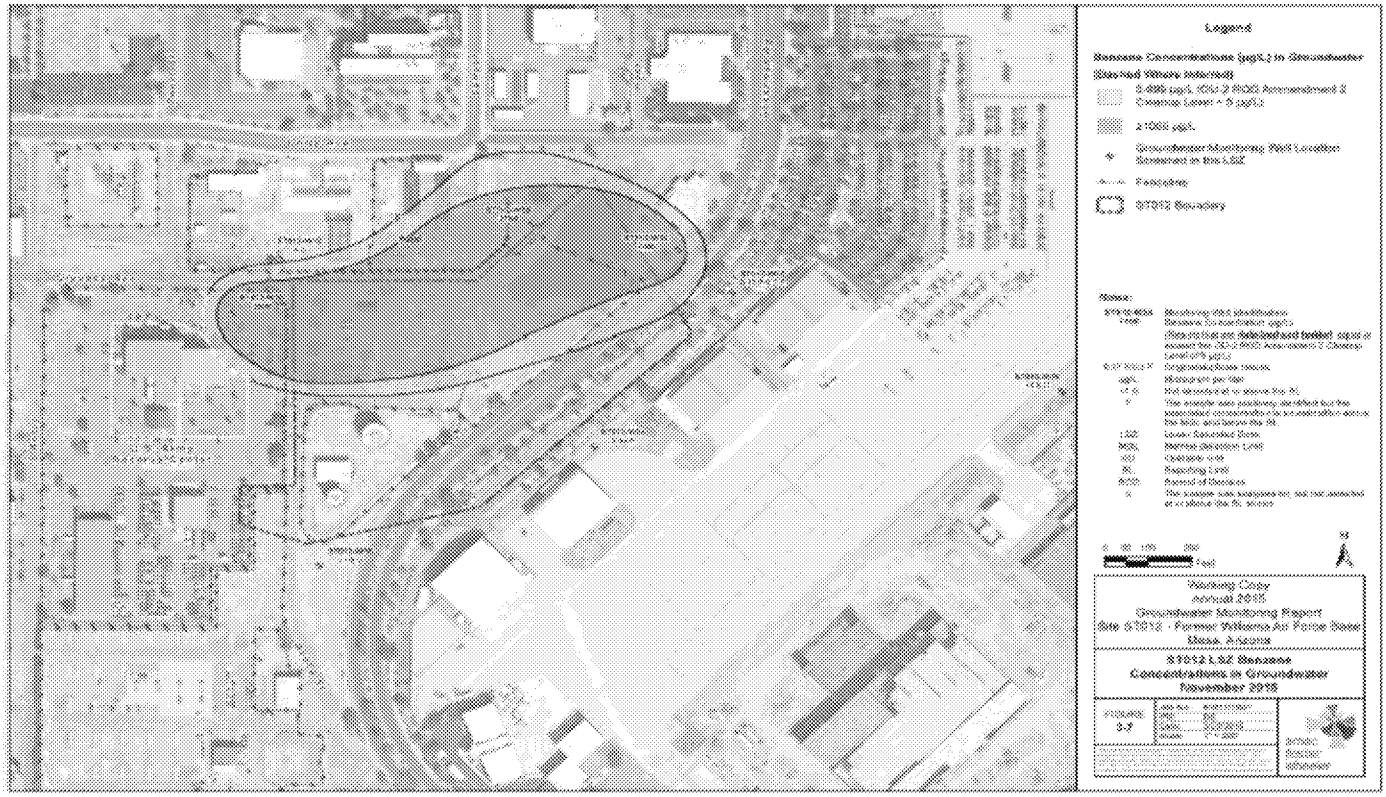
About 6 weeks after startup of SEE, site not even at steam temps yet dark pink is 1000 ppb contour line. Where did 5000 ppb contour line go?

LSZ Benzene Concentrations Nov 2014



Why have dissolved benzene concentrations moved north during SEE operations ? Is this representation realistic when there is LNAPL documented as present in wells outside of these contours?

LSZ Benzene Concentrations Nov 2015



Conclusions / Questions

1) LNAPL and dissolved phase plumes are not stable, but probably moving.
2) Do these figures accurately reflect actual conditions?
3) Focus has been on the LSZ rather than the UWBZ and cobble zone, where contaminants are most likely to be mobilized off site – why isn't Amec presenting the UWBZ/ Cobble Zone data?
4) Could LNAPLor dissolved phase BTEX have been mobilized upward from the LSZ into the UWBZ/ Cobble Zone during thermal treatment?
5) Benzene concentrations between different figures range from over 10000 ppb to less than 5 ppb within the same locations over time, even in areas that were not directly treated with steam. Does this make sense?
6) Why isnt AF/Amec willing to characterize baseline conditions (extent of LNAPL and, benzene concentrations in soil cores post SEE) before initiating EBR?
7) Without knowing baseline conditions, how can milestones be established for meeting the RAO of achieving MCLs within 20 years?
8) If milestones for meeting RAOs cannot be established; do we have grounds already for declaring remedy failure?

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"Because a waste is a terrible thing to mind…"