2025-11-20_Gasco: FS Comments Work Session

Meeting Title:	Gasco: FS Comments Work Session
Date/Time:	November 20, 2025 / 12:30 - 2:30 pm
Attendees:	NW Natural: Bob Wyatt Pearl: Patty Dost AQ: Halah Voges, Matt Davis, Ryan Barth EE: Rob Ede DOJ: Gary Vrooman DEQ: Wes Thomas, Dave Lacey, Dan Hafley, Heidi Nelson, Amber Lutey (remote), Sarah Van Glubt GEI: Carissa Mason (remote), Paul Jensen (remote), Matt O'Neil (remote), Tom Daigle (remote) *note - not all attendees participated in all discussions
Location:	DEQ NW Region Office / MS Teams

Meeting Notes:

- NW Natural, AQ, and EE review meeting materials which include
    - "DEQ Gasco OU FS GSA-Specific Alternatives Workshop" slides (attached)
    - Gasco OU FS GSA Tables (Tables 14-2 through 14-4k) (attached)

- DEQ questions and feedback:
    - DEQ asks for clarification of the quantities shown in Table 14-3.
        - AQ walks through each column of the table. DEQ and AQ discuss opportunities to clarify the information.

    - The tables imply that some portion of the Tar Ponds is inaccessible. DEQ was not aware of any accessibility constraints that apply to the Tar Ponds GSA.
        - AQ clarifies that a portion of the Tar Ponds GSA that overlaps with the LNG basin is considered inaccessible.

    - DEQ recommends providing the saturation-adjusted and recoverable DNAPL volumes in terms of gallons instead of cubic yards.

    - DEQ comments that the deeper containment wall proposed in Alternative 3 may not be needed at some of the higher RAAs

    - These gradations appear to represent two 'parallel' tracks of DNAPL treatment RAAs, one that focuses on all DNAPL and the other that focuses on potentially recoverable DNAPL. The two paths do not necessarily represent a single set of graduated alternatives. Tracking how these two parallel tracks graduate after Alternative 4 could be difficult and the FS will likely need to develop a way to evaluate the two 'tracks'.

    - The risk pathways do not fully align with the RAOs established for the FS. For example, while leaching to groundwater pathways are included, the actual groundwater pathways are not. The information does not communicate to what extent groundwater beneficial uses are restored by these alternatives.
        - NW Natural understands DEQ's comment. Adding in how each alternative addresses groundwater restoration is more difficult to implement in some GSAs than in others.
        - AQ notes that groundwater restoration likely also depends on actions taken outside of the GSA.
        - NW Natural will think through how to address DEQ's feedback.

    - The remedial alternatives focus on ISS and asks if excavation is also being considered.
        - NW Natural and DEQ discuss the need for flexibility in the ROD to allow either ISS or excavation.

    - The scale or magnitude between the alternatives is not even, so it could be difficult to really understand the knee of the curve using bar charts. DEQ very quickly and roughly developed

different versions of these charts that focus on quantities versus cost in a scatter chart format, instead of a bar chart format to better illustrate the separation between the alternatives. DEQ recommends that the FS look at the results with different methods to inform remedy selection.

- Next Steps
    - DEQ does not think an open ended series of meetings is in the best interest of the FS schedule. For context, it has been about 2.5 months since we last met, and we are about 4.5 months from the FS due date. While we have been open to providing feedback on concepts as they are developed, we need to balance the relative benefit of another meeting with the need to meet the FS schedule.
        - NW Natural thinks that another meeting is necessary and expresses the desire to ensure that the Revised FS will be approvable. NW Natural believes that the relative benefit of another meeting, or the risk of getting the site-wide RAA development wrong, is too high not to get DEQ's feedback.
        - DEQ asks NW Natural to commit to a date. The meeting should not be scheduled past January 2026. NW Natural commits to that timeframe and agrees to provide meeting materials in advance.
        - DEQ, EE, and AQ will schedule the exact date/time in a follow up meeting.
    - AQ proposes settling DEQ's data screening comments in the FS by keeping the baseline dataset the same, but updating the current conditions dataset to select the higher of two detected results when two lab methods reported a result for the same chemical, per DEQ's comment. DEQ agrees to the approach.
    - AQ/EE confirm the desire to meet again to discuss DNAPL dissolution in December.

DEQ Gasco OU FS GSA-Specific Alternatives Workshop

November 20, 2025

ANCHOR QEA

Preliminary Draft Discussion Document | Do Not Quote or Cite

Agenda

- Review previous workshop and objectives for this meeting
- Revised GSA-specific alternatives evaluation based on DEQ comments/recommendations
- DEQ feedback
- Next steps

NW Natural Homework from September 2, 2025, Workshop

- NW Natural agreed to develop a series of tables for each GSA-specific alternative that identify the following for each depth interval:
  - Risk pathways addressed
  - Treatment or removal technologies
  - Volume of hot spots in GSA
  - Hot spot treatment or removal volumes
  - Percent of hot spot treatment or removal
  - Treatment/removal cost
- NW Natural agreed to assemble updated technology assignments and alternatives for each GSA to incorporate DEQ priorities

Objectives for This Meeting

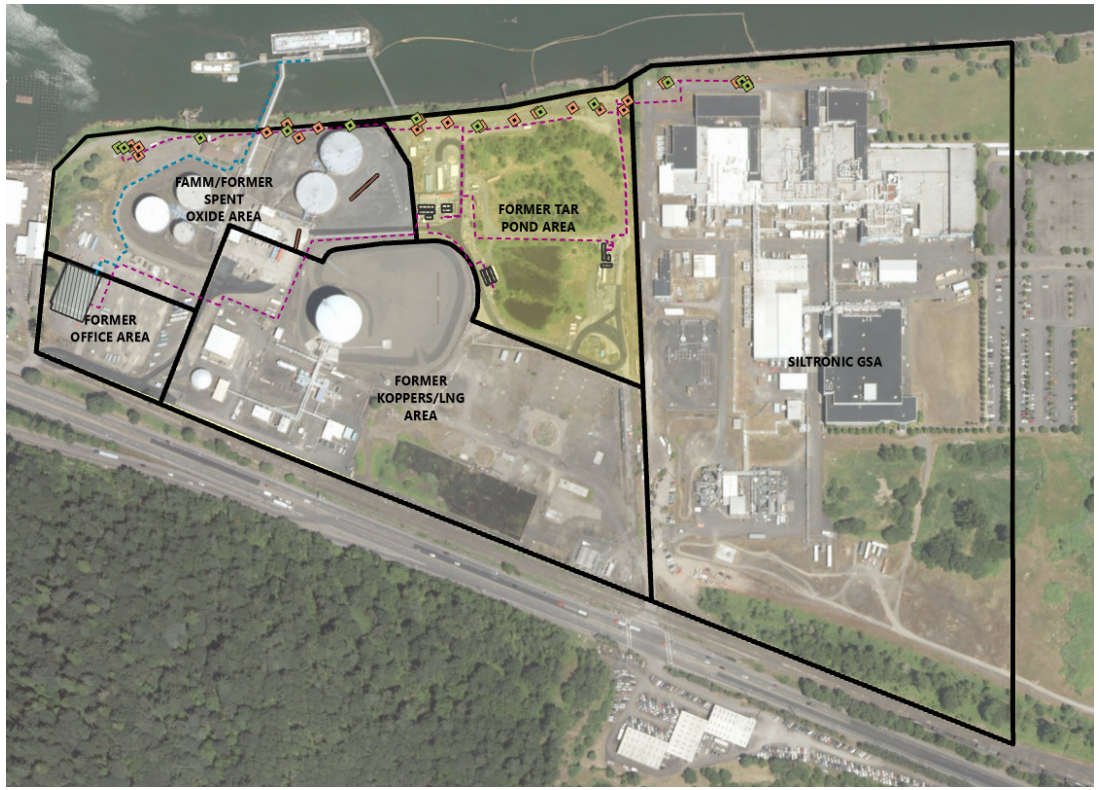
- Obtain DEQ feedback on our approach for to evaluating hot spot treatment on a GSA-specific basis
- Check that our approach results in sufficient gradations of alternatives for DEQ remedy selection
- Discuss next steps

DEQ-Requested Elements Added to GSA-Specific Alternatives

- Greater extent of hot treatment in earlier alternatives
- Benefits of hot spot treatment evaluated on a GSA basis
- Quantification of all hot spot volumes
- More gradations of hot spot treatment
- Hot spot treatment volume vs cost
- Revised accessibility (Fab 1 and tank basins)
- Inclusion of additional technologies for treatment of priority areas (e.g., elevated benzene area, spent oxide area, PRBs near Doane Creek and Segment 3 shoreline)

Revised GSA-Specific Alternatives Evaluation

Former Tar Pond Area example to illustrate NW Natural's proposed approach to resolve DEQ comments



Development of GSA-Specific Alternatives

- NW Natural developed 12 alternatives for the Former Tar Pond Area (includes no action and one that relies only engineering/source controls)
- Successive alternatives include incrementally more hot spot treatment starting with treatment of all accessible surface soil hot spots and ending with treatment of all accessible hot spots
- DNAPL recovery is proposed in alternatives where potentially mobile DNAPL is not treated using ISS
- Groundwater diversion (ISS containment cell) is proposed in alternatives where DNAPL is left untreated

Alternatives 1–4

- Alternative 1 – No action
- Alternative 2 – IRAM + engineering controls (capping, institutional controls, source controls)
- Alternative 3
  - All components from Alternative 2
  - **ISS of all accessible surface soil hot spots* (applies to all GSAs)**
  - ISS containment cell with **deeper portion along the northern segment to protect BU**
- Alternative 4
  - All components from Alternative 3
  - **ISS of all accessible surface and subsurface soil hot spots* (applies to all GSAs)**

*** As requested, we have added more treatment in earlier alternatives**

Alternatives 5–7

- Alternative 5
  - All components from Alternative 4
  - **ISS auger mix of all accessible transitional and potentially mobile DNAPL to the base of the Fill WBZ***
- Alternative 6
  - All components from Alternative 4
  - **ISS auger mix of all accessible hot spots to the base of the Fill WBZ***
- Alternative 7
  - All components from Alternative 4
  - **ISS of all accessible transitional and potentially mobile DNAPL to 25 feet below the base of the Fill WBZ***

*** As requested, we have included additional gradations of hot spot treatment**

Alternatives 7a–8a

- Alternative 7a
  - All components from Alternative 4
  - **ISS of all accessible DNAPL to 25 feet below the base of the Fill WBZ***
- Alternative 8
  - All components from Alternative 4
  - **ISS of all accessible transitional and potentially mobile DNAPL to 50 feet below the base of the Fill WBZ***
- Alternative 8a
  - All components from Alternative 4
  - **ISS of all accessible DNAPL to 50 feet below the base of the Fill WBZ***

*** As requested, we have included additional gradations of hot spot treatment**

Alternatives 9 and 9a

- Alternative 9
  - All components from Alternative 4
  - **ISS of all accessible transitional and potentially mobile DNAPL to all depths***
- Alternative 9a
  - All components from Alternative 4
  - **ISS of all accessible hot spots to all depths***

*** As requested, we have included additional gradations of hot spot treatment**

Volume and Risk Pathway Tables

- One table for each GSA-specific alternative that includes the following information for each depth interval:
  - **Treatment/removal technologies**
  - Risk pathways addressed
  - Volumes of hot spot-containing soil within the GSA (all, **accessible, DNAPL,** IRAM)
  - Treated volumes of hot spot-containing soil (all, **accessible, DNAPL**, IRAM)
  - Saturation-adjusted DNAPL volumes (volumes of pure DNAPL)
  - Where DNAPL recovery is proposed, the theoretically recoverable volume of DNAPL
  - Percent hot spot treatment (all and **accessible**)
  - FS and IRAM hot spot treatment **costs**

Note: **Bold** indicates elements DEQ requested during previous meeting

Risk Pathway Assessment

- For each risk pathway, the volume of hot spot-containing soil can be quantified; examples include the following:
  - Hot spots in the 0–3.5′ depth interval present complete Human Health (HH) and Ecological (Eco) surface soil exposure pathways
  - Hot spots in the 0–3.5′, 3.5′–12′, and 12′ to base of Fill WBZ depth intervals present complete HH and Eco Fill WBZ groundwater exposure pathways as well as a potential vapor intrusion exposure pathway
- The percent treatment of hot spots presenting a complete risk pathway can be quantified
  - An alternative that treats 95% of the surface soil (0–3.5′) hot spots addresses 95% of the both the HH and Eco surface soil risk pathways; this is equivalent to treating 1.9 risk pathways (0.95 +0.95 =1.9)
  - Our calculation includes both accessible and inaccessible hot spots
- The percentages of each risk pathway addressed for a given alternative are summed to determine the total number of risk pathways addressed through treatment or removal

Hot Spot Treatment Volumes

- Hot spot treatment volumes include volume of hot spot-containing soil (cy) for all non-groundwater hot spot types
- Volume of hot spot treatment associated with DNAPL recovery is not included in overall treatment volume calculations
  - DNAPL recovery treats hot spots as a standalone technology but does not completely address a risk pathway; theoretically recoverable DNAPL volume included for informational purposes
- IRAM treatment volumes are shown separately but are included in overall treatment volume calculations
  - Include currently proposed nearshore DNAPL ISS prisms and surface and subsurface soil hot spots in proposed HC&C corridor; subject to change based on design investigations
- Accessible hot spots include areas accessible for intrusive work (vast majority of Former Tar Pond Area)
- Saturation-adjusted DNAPL volumes are calculated by multiplying volume of treated soils for each DNAPL mobility classification by representative soil porosity and DNAPL saturation

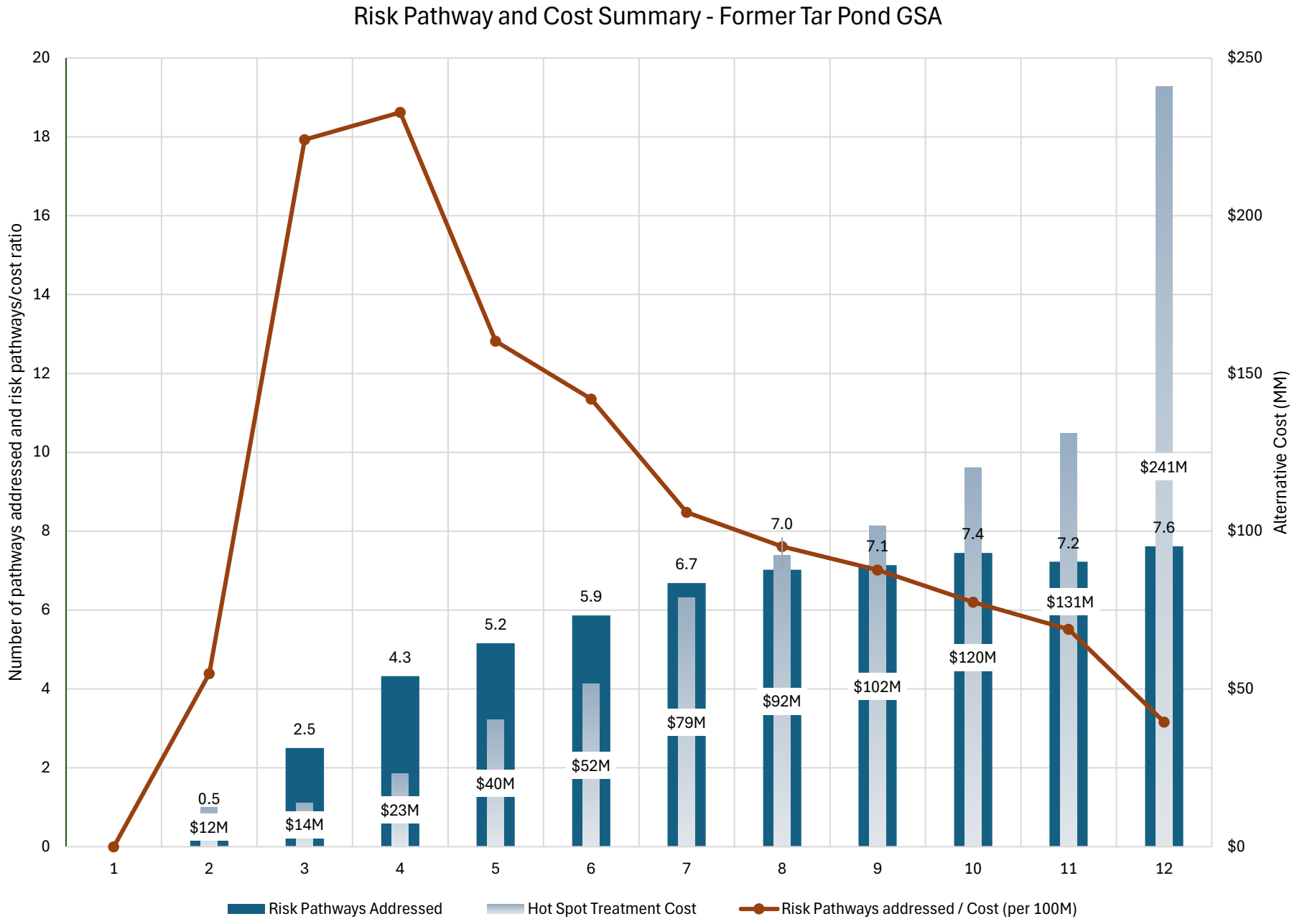
Costs

- Estimated costs are for comparative purposes and are only for hot spot treatment and do not include other technologies that are components of GSA-specific alternatives such as hydraulic containment, containment cells, infiltration control, MNA, etc.; these additional costs will be evaluated if carried forward into the site-wide alternatives
- For ISS treatment, costs are based on the total treatment volumes which necessarily include ISS of non-hot spot overburden soils
- Unit rates for ISS treatment increase considerably with depth due to types of equipment needed (CSM for deeper work) and production rates

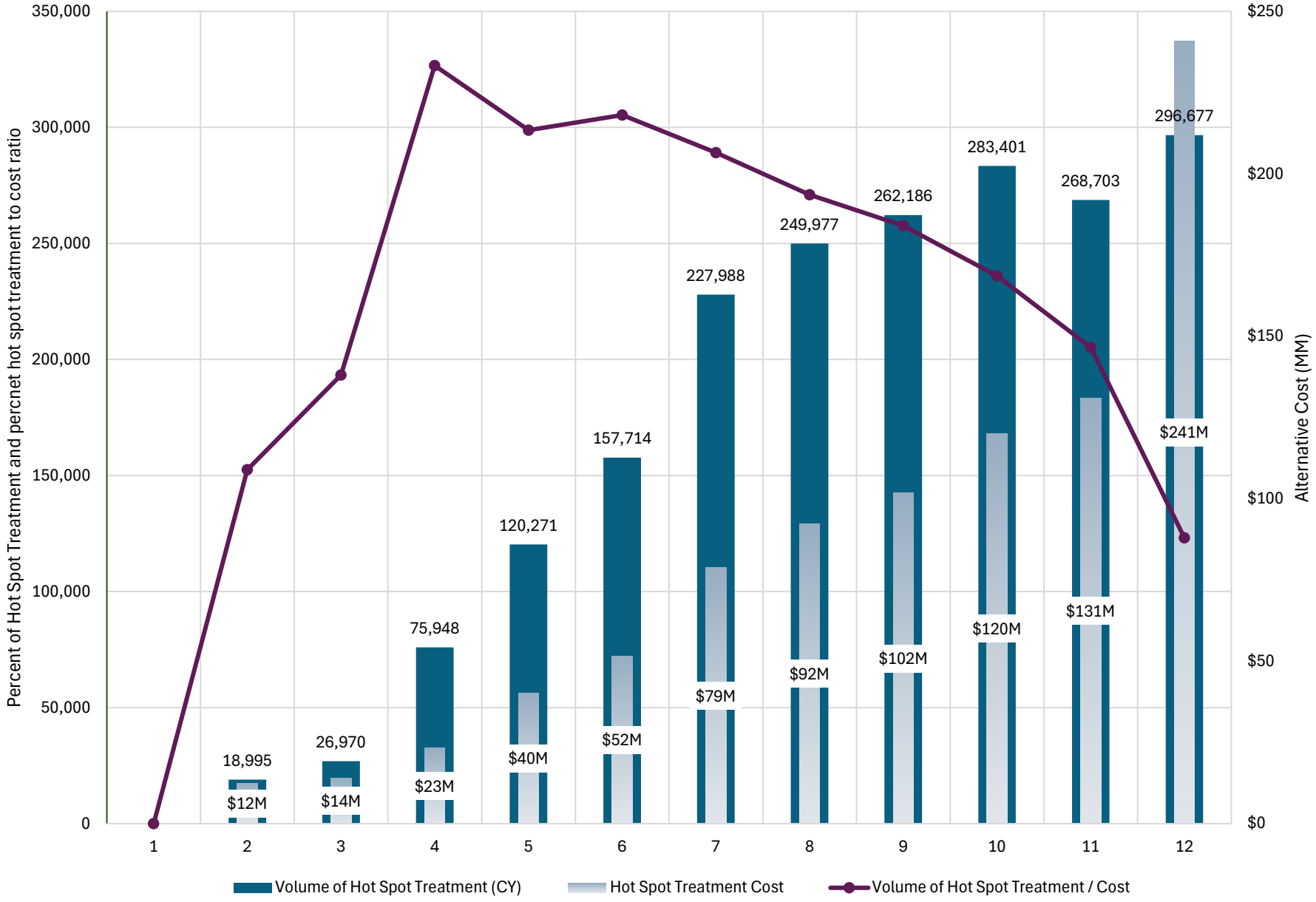
Summary of Results

Former Tar Pond Area Summary Table

GSA Alternative	Number of Risk Pathways Addressed	Volume of Hot Spot-Containing Soil Treated (cy)		Percent of Soil Hot Spot Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA
		All	Accessible	Accessible	All		
1	0	0	0	0%	0%	$0M	$0M
2	0.5	18,995	0	0%	6%	$0M	$12M
3	2.5	26,970	7,975	3%	8%	$2M	$12M
4	4.3	75,948	56,953	21%	24%	$11M	$12M
5	5.2	120,271	101,276	36%	38%	$28M	$12M
6	5.9	157,714	138,719	50%	50%	$39M	$12M
7	6.7	227,988	208,992	75%	72%	$66M	$12M
7a	7.0	249,977	230,981	83%	79%	$80M	$12M
8	7.1	262,186	243,191	88%	82%	$89M	$12M
8a	7.4	283,401	264,406	95%	89%	$108M	$12M
9	7.2	268,703	249,708	90%	84%	$119M	$12M
9a	7.6	296,213	277,218	100%	93%	$229M	$12M


Risk Pathway and Cost Summary - Former Tar Pond GSA
Number of pathways addressed and risk pathways/cost ratio
Alternative Cost (MM)
0
2
4
6
8
10
12
14
16
18
20
$0
$50
$100
$150
$200
$250
1
2
3
4
5
6
7
8
9
10
11
12
0.5
$12M
2.5
$14M
4.3
$23M
5.2
$40M
5.9
$52M
6.7
$79M
7.0
$92M
7.1
$102M
7.4
$120M
7.2
$131M
7.6
$241M
Risk Pathways Addressed
Hot Spot Treatment Cost
Risk Pathways addressed / Cost (per 100M)

Hot Spot Treatment Volume and Cost Summary –Former Tar Pond GSA



DEQ Feedback

DEQ Feedback

- Does this provide the appropriate number of hot spot treatment gradations?
- Does the table capture the elements DEQ feels are necessary for evaluating hot spots?
- Any specific feedback to consider prior to completing this work and assembling preliminary site-wide alternatives?
- Other?

Next Steps

Next Steps

- Obtain DEQ agreement that we use this approach and complete GSA-specific alternatives evaluation
- Combine GSA-specific alternatives
  - Determine number of site-wide alternatives
  - Combine into site-wide alternatives
- Meet with DEQ to review proposed site-wide alternatives
- Finalize site-wide alternatives and produce revised FS

What questions do you have?

Table 14-2
Risk Pathway Assessment Table – Former Tar Pond Area

Risk Pathway[1]	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 7a	Alternative 8	Alternative 8a	Alternative 9	Alternative 9a
HH – Surface Soil	0%	8%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Eco – Surface Soil	0%	8%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
HH – Subsurface Soil	0%	8%	8%	99%	99%	99%	99%	99%	99%	99%	99%	99%
HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization[2]	0%	7%	12%	42%	70%	93%	87%	93%	89%	93%	89%	93%
HH – Fill WBZ Groundwater (excavation worker)[2]	0%	7%	12%	42%	70%	93%	87%	93%	89%	93%	89%	93%
Eco – Fill WBZ Groundwater[2]	0%	7%	12%	42%	70%	93%	87%	93%	89%	93%	89%	93%
Eco – Alluvium WBZ Groundwater[3]	0%	5%	5%	5%	5%	5%	56%	64%	75%	85%	79%	93%
HH – Alluvium WBZ Groundwater (industrial use)[3]	0%	5%	5%	5%	5%	5%	56%	64%	75%	85%	79%	93%
Number of Pathways Addressed:	**0.0**	**0.5**	**2.5**	**4.3**	**5.2**	**5.9**	**6.7**	**7.0**	**7.1**	**7.4**	**7.2**	**7.6**

Notes:

Percent of risk pathway addressed is calculated for each pathway by determining the percent of the total volume of hot spots contributing to the pathway that is treated for each alternative.

1. Risk pathways present in the Former Tar Pond Area based on the evaluation presented in the RI/HERA Addendum (Anchor QEA and HAI 2019).

2. Hot spots contributing to this pathway include hot spots in the 0–3.5, 3.5–12, and 12 feet to the base of Fill WBZ depth intervals.

3. Hot spots contributing to this pathway include hot spots in all depth intervals below the base of the Fill WBZ.

Eco: ecological

HH: human health

RI/HERA Addendum: *Remedial Investigation/Human Health and Ecological Risk Assessment Addendum for the Siltronic GSA*

WBZ: water-bearing zone

Reference:

Anchor QEA and HAI (Hahn and Associates, Inc.), 2019. *Remedial Investigation/Human Health and Ecological Risk Assessment Addendum for the Siltronic GSA.* Gasco OU. Prepared for NW Natural. November 22, 2019.

Table 14-3
Volume and Risk Pathway Summary Table – Former Tar Pond Area

GSA Alternative	Treatment/Removal Technologies	Risk Pathways Addressed by Treatment/Removal of Hot Spots	Number of Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA
				All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]		
1	none	none	0	318,309	277,681	216,936	34,745	0	0	0	0	0	0.0	0%	0%	$0M	$0M
2	IRAM ISS	●HH – Surface Soil (8%) ●Eco – Surface Soil (8%) ●HH – Subsurface Soil (8%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (7%) ●HH – Fill WBZ Groundwater (excavation worker) (7%) ●Eco – Fill WBZ Groundwater (7%) ●Eco – Alluvium WBZ Groundwater (5%) ●HH – Alluvium WBZ Groundwater (industrial use) (5%)	0.5					18,995	0	0	18,995	553	2,874	0%	6%	$0M	$12M
3	• IRAM ISS • ISS bucket mix or excavation of hot spots to 3.5 feet	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (8%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (12%) ●HH – Fill WBZ Groundwater (excavation worker) (12%) ●Eco – Fill WBZ Groundwater (12%) ●Eco – Alluvium WBZ Groundwater (5%) ●HH – Alluvium WBZ Groundwater (industrial use) (5%)	2.5					26,970	7,975	306	18,995	572	2,874	3%	8%	$2M	$12M
4	• IRAM ISS • ISS bucket mix of hot spots to 12 feet	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (42%) ●HH – Fill WBZ Groundwater (excavation worker) (42%) ●Eco – Fill WBZ Groundwater (42%) ●Eco – Alluvium WBZ Groundwater (5%) ●HH – Alluvium WBZ Groundwater (industrial use) (5%)	4.3					75,948	56,953	5,057	18,995	850	2,874	21%	24%	$11M	$12M
5	• IRAM ISS • ISS auger mix of hot spots to 12 feet and transitional and potentially mobile DNAPL to the base of the Fill WBZ	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (70%) ●HH – Fill WBZ Groundwater (excavation worker) (70%) ●Eco – Fill WBZ Groundwater (70%) ●Eco – Alluvium WBZ Groundwater (5%) ●HH – Alluvium WBZ Groundwater (industrial use) (5%)	5.2					120,271	101,276	30,297	18,995	3,259	2,874	36%	38%	$28M	$12M

Table 14-3
Volume and Risk Pathway Summary Table – Former Tar Pond Area

GSA Alternative	Treatment/Removal Technologies	Risk Pathways Addressed by Treatment/Removal of Hot Spots	Number of Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA
				All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]		
6	• IRAM ISS • ISS auger mix of hot spots to the base of the Fill WBZ	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (93%) ●HH – Fill WBZ Groundwater (excavation worker) (93%) ●Eco – Fill WBZ Groundwater (93%) ●Eco – Alluvium WBZ Groundwater (5%) ●HH – Alluvium WBZ Groundwater (industrial use) (5%)	5.9					157,714	138,719	51,398	18,995	4,494	2,874	50%	50%	$39M	$12M
7	• IRAM ISS • ISS auger mix of hot spots to 12 feet and transitional and potentially mobile DNAPL to 25 feet below the base of the Fill WBZ	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (87%) ●HH – Fill WBZ Groundwater (excavation worker) (87%) ●Eco – Fill WBZ Groundwater (87%) ●Eco – Alluvium WBZ Groundwater (56%) ●HH – Alluvium WBZ Groundwater (industrial use) (56%)	6.7					227,988	208,992	126,087	18,995	11,421	2,874	75%	72%	$66M	$12M
7a	• IRAM ISS • ISS auger mix of hot spots to 12 feet and all DNAPL to 25 feet below the base of the Fill WBZ	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (93%) ●HH – Fill WBZ Groundwater (excavation worker) (93%) ●Eco – Fill WBZ Groundwater (93%) ●Eco – Alluvium WBZ Groundwater (64%) ●HH – Alluvium WBZ Groundwater (industrial use) (64%)	7.0	318,309	277,681	216,936	34,745	249,977	230,981	144,431	18,995	12,653	2,874	83%	79%	$80M	$12M
8	• IRAM ISS • ISS auger mix of hot spots to 12 feet and transitional and potentially mobile DNAPL to 50 feet below the base of the Fill WBZ	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (89%) ●HH – Fill WBZ Groundwater (excavation worker) (89%) ●Eco – Fill WBZ Groundwater (89%) ●Eco – Alluvium WBZ Groundwater (75%) ●HH – Alluvium WBZ Groundwater (industrial use) (75%)	7.1					262,186	243,191	159,587	18,995	14,798	2,874	88%	82%	$89M	$12M
8a	• IRAM ISS • ISS auger mix of hot spots to 12 feet and all DNAPL to 50 feet below the base of the Fill WBZ	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (93%) ●HH – Fill WBZ Groundwater (excavation worker) (93%) ●Eco – Fill WBZ Groundwater (93%) ●Eco – Alluvium WBZ Groundwater (85%) ●HH – Alluvium WBZ Groundwater (industrial use) (85%)	7.4					283,401	264,406	177,549	18,995	16,003	2,874	95%	89%	$108M	$12M

Table 14-3
Volume and Risk Pathway Summary Table – Former Tar Pond Area

GSA Alternative	Treatment/Removal Technologies	Risk Pathways Addressed by Treatment/Removal of Hot Spots	Number of Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA
				All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]		
9	• IRAM ISS • ISS auger/cutter soil mix of hot spots to 12 feet and transitional and potentially mobile DNAPL to all depths	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (89%) ●HH – Fill WBZ Groundwater (excavation worker) (89%) ●Eco – Fill WBZ Groundwater (89%) ●Eco – Alluvium WBZ Groundwater (79%) ●HH – Alluvium WBZ Groundwater (industrial use) (79%)	7.2	318,309	277,681	216,936	34,745	268,703	249,708	197,812	18,995	15,602	2,874	90%	84%	$119M	$12M
9a	• IRAM ISS • ISS auger/cutter soil mix all hot spots to all depths	●HH – Surface Soil (99%) ●Eco – Surface Soil (99%) ●HH – Subsurface Soil (99%) ●HH – Surface & Subsurface Soil and Fill WBZ Groundwater Volatilization (93%) ●HH – Fill WBZ Groundwater (excavation worker) (93%) ●Eco – Fill WBZ Groundwater (93%) ●Eco – Alluvium WBZ Groundwater (93%) ●HH – Alluvium WBZ Groundwater (industrial use) (93%)	7.6					296,677	277,682	190,361	18,995	16,967	2,874	100%	93%	$229M	$12M

Notes:
* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots
1. All hot spots includes accessible, inaccessible, and IRAM (HC&C corridor and nearshore upland ISS area)
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot containing soils in the currently ISS treatment prisms and the volume of hot spot containing soils in the 0-12/20' bgs depth interval
4. Volume of DNAPL (in cubic yards) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods

cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
WBZ: water-bearing zone

Table 14-4a
Alternative 2 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	IRAM ISS	• HH Surface Soil Direct Contact – Occupational • HH Surface Soil Direct Contact – Construction Worker • HH Volatilization (VI) • Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	733	0	0	733	0.2	0	0%	8%		0.0M	
3.5–12 Feet bgs	IRAM ISS	• HH Surface Soil Direct Contact – Construction Worker • HH Volatilization (VI) • Leaching to GW (Eco SW pathway) • HH Fill WBZ Direct Contact - Excavation Worker	53,877	48,978	4,936	4,109	4,109	0	0	4,109	3	0	0%	8%		0.0M	
12 Feet–Base of Fill WBZ	IRAM ISS	• HH Volatilization (VI) • Leaching to GW (Eco SW pathway) • HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	5,758	0	0	5,758	6	500	0%	6%		0.3M	
0–25 Feet Below Base of Fill WBZ	IRAM ISS	• Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	4,991	0	0	4,991	11	1,420	0%	5%		1.9M	
25–50 Feet Below Base of Fill WBZ	IRAM ISS	• Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	1,309	0	0	1,309	10	831	0%	4%		1.7M	
50–75 Feet Below Base of Fill WBZ	IRAM ISS	• Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	IRAM ISS	• Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	IRAM ISS	• Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--			
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--			
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**18,995**	**0**	**0**	**18,995**	**553**	**2,874**	**0%**	**6%**	**0.0M**	**12.5M**	

Table 14-4a
Alternative 2 Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4b
Alternative 3 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment / Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.8	0	100%	99%	1.5M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	4,109	0	0	4,109	3	0	0%	8%		0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL Recovery[6]	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	5,758	0	0	5,758	6	500	0%	6%		0.3M	Volume of hot spot treatment via DNAPL recovery not included
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	4,991	0	0	4,991	11	1,420	0%	5%		1.9M	Volume of hot spot treatment via DNAPL recovery not included
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	1,309	0	0	1,309	10	831	0%	4%		1.7M	Volume of hot spot treatment via DNAPL recovery not included
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	-	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	-	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**26,970**	**7,975**	**306**	**18,995**	**572**	**2,874**	**3%**	**8%**	**1.5M**	**12.5M**	

Table 14-4b
Alternative 3 Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods
6. DNAPL recovery treats hot spots but as a standalone technology; it does not completely address a risk pathway.

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4c
Alternative 4 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8708	7,975	306	733	18.8	0	100%	99%	1.5M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	9.3M	0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL Recovery[6]	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	5,758	0	0	5,758	6	500	0%	6%		0.3M	Volume of hot spot treatment via DNAPL recovery not included
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	4,991	0	0	4,991	11	1,420	0%	5%		1.9M	Volume of hot spot treatment via DNAPL recovery not included
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	1,309	0	0	1,309	10	831	0%	4%		1.7M	Volume of hot spot treatment via DNAPL recovery not included
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**75,948**	**56,953**	**5,057**	**18,995**	**850**	**2,874**	**21%**	**24%**	**10.8M**	**12.5M**	

Table 14-4c
Alternative 4 Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods
6. DNAPL recovery treats hot spots but as a standalone technology; it does not completely address a risk pathway.

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4d
Alternative 5 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.8	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all transitional and potentially mobile DNAPL	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	50,081	44,323	25,240	5,758	2,415	500	54%	52%	15.9M	0.3M	
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	4,991	0	0	4,991	11	1,420	0%	5%		1.9M	Volume of hot spot treatment via DNAPL recovery not included
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	1,309	0	0	1,309	10	831	0%	4%		1.7M	Volume of hot spot treatment via DNAPL recovery not included
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
Totals:			**318,309**	**277,681**	**216,936**	**34,745**	**120,271**	**101,276**	**30,297**	**18,995**	**3,259**	**2,874**	**36%**	**38%**	**27.8M**	**12.5M**	

Table 14-4d
Alternative 5 Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods
6. DNAPL recovery treats hot spots but as a standalone technology; it does not completely address a risk pathway.

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4e
Alternative 6 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.8	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all DNAPL	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	87,524	81,766	46,341	5,758	3,650	500	100%	90%	27.3M	0.3M	
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	4,991	0	0	4,991	11	1,420	0%	5%		1.9M	Volume of hot spot treatment via DNAPL recovery not included
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	1,309	0	0	1,309	10	831	0%	4%		1.7M	Volume of hot spot treatment via DNAPL recovery not included
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**157,714**	**138,719**	**51,398**	**18,995**	**4,494**	**2,874**	**50%**	**50%**	**39.2M**	**12.5M**	

Table 14-4e
Alternative 6 Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods
6. DNAPL recovery treats hot spots but as a standalone technology; it does not completely address a risk pathway.

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4f
Alternative 7 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.8	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all transitional and potentially mobile DNAPL	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	77,309	71,550	40,541	5,758	3,118	500	88%	80%	15.9M	0.3M	
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all transitional and potentially mobile DNAPL	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	85,480	80,489	80,489	4,991	7,469	1,420	87%	82%	38.6M	1.9M	
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	1,309	0	0	1,309	10	831	0%	4%		1.7M	Volume of hot spot treatment via DNAPL recovery not included
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**227,988**	**208,992**	**126,087**	**18,995**	**11,421**	**2,874**	**75%**	**72%**	**66.4M**	**12.5M**	

Table 14-4f
Alternative 7 Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods
6. DNAPL recovery treats hot spots but as a standalone technology; it does not completely address a risk pathway.

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4g
Alternative 7a Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.8	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all DNAPL	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	86,752	80,994	46,341	5,758	3,650	500	99%	89%	39.2M	0.3M	
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all DNAPL	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	98,025	93,034	93,034	4,991	8,170	1,420	100%	94%	28.7M	1.9M	
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ DNAPL recovery[6]	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	1,309	0	0	1,309	10	831	0%	4%		1.7M	Volume of hot spot treatment via DNAPL recovery not included
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
Totals:			**318,309**	**277,681**	**216,936**	**34,745**	**249,977**	**230,981**	**144,431**	**18,995**	**12,653**	**2,874**	**83%**	**79%**	**79.8M**	**12.5M**	

Table 14-4g
Alternative 7a Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods
6. DNAPL recovery treats hot spots but as a standalone technology; it does not completely address a risk pathway.

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4h
Alternative 8 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.8	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all transitional and potentially mobile DNAPL	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	80,960	75,202	43,494	5,758	3,483	500	92%	83%	15.9M	0.3M	
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all transitional and potentially mobile DNAPL	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	89,655	84,664	84,664	4,991	7,507	1,420	91%	86%	38.6M	1.9M	
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all transitional and potentially mobile DNAPL	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	27,682	26,372	26,372	1,309	2,984	831	80%	75%	22.9M	1.7M	
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**262,186**	**243,191**	**159,587**	**18,995**	**14,798**	**2,874**	**88%**	**82%**	**89.3M**	**12.5M**	

Table 14-4h
Alternative 8 Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4i
Alternative 8a Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Occupational ▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.1	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	▪ IRAM ISS ▪ ISS bucket mix or excavation of all hot spots	▪ HH Surface Soil Direct Contact – Construction Worker ▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all DNAPL	▪ HH Volatilization (VI) ▪ Leaching to GW (Eco SW pathway) ▪ HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	87,060	81,302	46,341	5,758	3,650	500	99%	90%	39.2M	0.3M	
0–25 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all DNAPL	▪ Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	98,025	93,034	93,034	4,991	8,170	1,420	100%	94%	38.2M	1.9M	
25–50 Feet Below Base of Fill WBZ	▪ IRAM ISS ▪ Auger mix all DNAPL	▪ Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	34,426	33,117	33,117	1,309	3,361	831	100%	94%	18.3M	1.7M	
50–75 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	1,842	0	0	1,842	40	102	0%	13%		3.5M	
75–100 Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	228	0	0	228	299	21	0%	11%		4.2M	
100–125 Feet Below Base of Fill WBZ	▪ IRAM ISS	▪ Leaching to GW (Eco SW pathway)	318	163	318	153	25	0	0	25	185	0	0%	8%		0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**283,401**	**264,406**	**177,549**	**18,995**	**16,003**	**2,874**	**95%**	**89%**	**107.6M**	**12.5M**	

Table 14-4i
Alternative 8a Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4j
Alternative 9 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	• IRAM ISS • ISS bucket mix or excavation of all hot spots	• HH Surface Soil Direct Contact – Occupational • HH Surface Soil Direct Contact – Construction Worker • HH Volatilization (VI) • Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.8	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	• IRAM ISS • ISS bucket mix or excavation of all hot spots	• HH Surface Soil Direct Contact – Construction Worker • HH Volatilization (VI) • Leaching to GW (Eco SW pathway) • HH Fill WBZ Direct Contact – Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	• IRAM ISS • Auger mix all transitional and potentially mobile DNAPL	• HH Volatilization (VI) • Leaching to GW (Eco SW pathway) • HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	81,058	75,300	75,300	5,758	3,485	500	92%	83%	15.9M	0.3M	
0–25 Feet Below Base of Fill WBZ	• IRAM ISS • Auger mix all transitional and potentially mobile DNAPL	• Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	89,862	84,870	84,870	4,991	7,714	1,420	91%	86%	38.6M	1.9M	
25–50 Feet Below Base of Fill WBZ	• IRAM ISS • Auger mix all transitional and potentially mobile DNAPL	• Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	28,542	27,232	27,232	1,309	3,032	831	82%	78%	22.9M	1.7M	
50–75 Feet Below Base of Fill WBZ	• IRAM ISS • Auger mix all transitional and potentially mobile DNAPL	• Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	6,589	4,747	4,747	1,842	513	102	43%	45%	--	3.5M	
75–100 Below Base of Fill WBZ	• IRAM ISS • Auger mix all transitional and potentially mobile DNAPL	• Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	823	595	595	228	372	21	38%	41%	--	4.2M	

Table 14-4j
Alternative 9 Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
100–125 Feet Below Base of Fill WBZ	• IRAM ISS • Auger mix all transitional and potentially mobile DNAPL	• Leaching to GW (Eco SW pathway)	318	163	318	153	35	11	11	25	186	0	6%	11%	29.2M	0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**268,703**	**249,708**	**197,812**	**18,995**	**15,602**	**2,874**	**90%**	**84%**	**118.5M**	**12.5M**	

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone

Table 14-4k
Alternative 9a Volume and Risk Pathway Table – Former Tar Pond Area

Depth Interval (feet bgs)	Treatment/ Removal Technologies	Risk Pathways Addressed	Volume of Hot Spot-Containing* Soil in GSA (cy)				Volume of Hot Spot-Containing* Soil Treated (cy)				Volume of Treated DNAPL (cy)		Percent of Soil Hot Spot* Volume Treated (%)		FS Soil Hot Spot Treatment Cost ($M)	IRAM Soil Hot Spot Treatment Cost ($M) in GSA	Notes
			All[1]	Accessible	DNAPL[2]	IRAM	All	Accessible	DNAPL[2]	IRAM[3]	Saturation Adjusted DNAPL[4]	Recoverable DNAPL[5]	Accessible	All[1]			
0–3.5 Feet bgs	• IRAM ISS • ISS bucket mix or excavation of all hot spots	• HH Surface Soil Direct Contact – Occupational • HH Surface Soil Direct Contact – Construction Worker • HH Volatilization (VI) • Leaching to GW (Eco SW pathway)	8,839	7,975	318	733	8,708	7,975	306	733	18.1	0	100%	99%	1.7M	0.0M	
3.5–12 Feet bgs	• IRAM ISS • ISS bucket mix or excavation of all hot spots	• HH Surface Soil Direct Contact – Construction Worker • HH Volatilization (VI) • Leaching to GW (Eco SW pathway) • HH Fill WBZ Direct Contact - Excavation Worker	53,877	48,978	4,936	4,109	53,087	48,978	4,751	4,109	281	0	100%	99%	10.2M	0.0M	
12 Feet–Base of Fill WBZ	• IRAM ISS • Auger mix all hot spots	• HH Volatilization (VI) • Leaching to GW (Eco SW pathway) • HH Fill WBZ Direct Contact Excavation Worker	97,168	81,766	53,257	13,761	87,524	81,766	46,341	5,758	3,650	500	100%	90%	39.2M	0.3M	
0–25 Feet Below Base of Fill WBZ	• IRAM ISS • Auger mix all hot spots	• Leaching to GW (Eco SW pathway)	104,793	93,034	104,793	9,703	98,025	93,034	93,034	4,991	8,170	1,420	100%	94%	38.2M	1.9M	
25–50 Feet Below Base of Fill WBZ	• IRAM ISS • Auger mix all hot spots	• Leaching to GW (Eco SW pathway)	36,740	33,117	36,740	2,918	34,426	33,117	33,117	1,309	3,361	831	100%	94%	18.3M	1.7M	
50–75 Feet Below Base of Fill WBZ	• IRAM ISS • Auger mix all hot spots	• Leaching to GW (Eco SW pathway)	14,557	11,095	14,557	2,938	12,937	11,095	11,095	1,842	868	102	100%	89%	--	3.5M	
75–100 Below Base of Fill WBZ	• IRAM ISS • CSM mix all hot spots	• Leaching to GW (Eco SW pathway)	2,017	1,554	2,017	430	1,782	1,554	1,554	228	425	21	100%	88%	--	4.2M	
100–125 Feet Below Base of Fill WBZ	• IRAM ISS • CSM mix all hot spots	• Leaching to GW (Eco SW pathway)	318	163	318	153	188	163	163	25	195	0	100%	59%	120.9M	0.9M	
125–150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
+150 Feet Below Base of Fill WBZ			0	0	0	0	0	0	0	0	0	0	--	--		0.0M	
		Totals:	**318,309**	**277,681**	**216,936**	**34,745**	**296,677**	**277,682**	**190,361**	**18,995**	**16,967**	**2,874**	**100.0%**	**93.2%**	**228.5M**	**12.5M**	

Table 14-4k
Alternative 9a Volume and Risk Pathway Table – Former Tar Pond Area

Notes:

* Soil hot spot volumes include the soil containing MGP residuals and highly concentrated soil hot spots.

--: not applicable

1. All hot spots includes accessible, inaccessible, and IRAM (HC&C system corridor and nearshore upland ISS area of interest).
2. Volume of DNAPL-containing soil
3. IRAM treatment volumes assume the volume of hot spot-containing soils in the current ISS treatment prisms and the volume of hot spot containing-soils in the 0–12/20 feet bgs depth interval.
4. Volume of DNAPL (in cy) in soil adjusted based on the saturation associated with the DNAPL mobility classes
5. Volume of recoverable DNAPL by hydraulic methods

bgs: below ground surface
cy: cubic yard
DNAPL: dense nonaqueous phase liquid
Eco: ecological
FS: feasibility study
GSA: geographic subarea
GW: groundwater
HC&C: hydraulic control and containment
HH: human health
IRAM: interim removal action measure
ISS: in situ stabilization and solidification
M: million
MGP: manufactured gas plant
SW: surface water
VI: vapor intrusion
WBZ: water-bearing zone