Table 17: Summary of Comparative Analysis of TVOC Alternatives

Assessment Factors	V1 - No Action	V2 - Natural Attenuation	V7 - On-site In-well Air Stripping/Off-site In-well Air Stripping at Hot Spots and at Brookhaven Airport	V10b - On-site In-Well Air Stripping/Off-site In-well Air Stripping at Hot Spots and at Brookhaven Airport	V10c - On-site In-well Air Stripping/Off-site In-well Air Stripping at Hot Spots and at Brookhaven Airport	V11- On-site In-well Air Stripping/Off-site In-well Air Stripping at Non-residential Areas/No Treatment at LIPA	V13- On-site and Off-site Extraction Wells with Treatment System On-site
Key Components	Regulatory requirements mandate detailed evaluation of the No Action alternative.	Source removal system using re-circulation wells with air stripping treatment near Building 96 and continued operation of on/off-site IRAs. Reduction of contaminants through naturally occurring means.	On- and off-site IRA systems and source removal system using re-circulation wells with air stripping treatment near Building 96 and on-site in-well air stripping at Middle Road. Off-site in-well air stripping wells at LIPA (1), Airport (8), North St. (3), North St. East (1) and the western low-level VOC plume (4). Monitoring and natural attenuation	On- and off-site IRA systems and source removal system using re-circulation wells with air stripping treatment near Building 96 and on-site in-well air stripping at Middle Road. Off-site in-well air stripping wells at Industrial Park (1), LIPA (3), Airport (7), North St. (4), North Street East (1). Monitoring and natural attenuation	On-site and off-site IRA systems, including the On-Site Southern Boundary IRA and the Off-Site Industrial Complex IRA, and source removal system using re-circulation wells with air stripping treatment near Building 96. Installation of new in-well air stripping systems at the Industrial Park (1), LIPA (3), Airport (7), North St. (4), North Street East (1), an additional treatment system on-site at Middle Road, and either in-well air stripping and/or expansion of the existing on-site pump & treat system for the Western low-level VOC plume (2). Monitoring and natural attenuation	On- and off-site IRA systems and source removal system using re-circulation wells with air stripping treatment near Building 96 and on-site in-well air stripping at Middle Road. Off-site in-well air stripping wells at Industrial Park (1), Airport (10), North St. (3), and North Street East(1). No treatment at LIPA. Monitoring and natural attenuation	On- and off-site IRA systems and source removal system using re-circulation wells with air stripping treatment near Building 96 and on-site extraction well at Middle Road. On- and off-site extraction wells at Industrial Park (1), LIPA (3), Airport (7), North St. (4), and North Street East (1). Monitoring and natural attenuation
Short-Term Effectiveness	Provides short-term protection of human health and the environment. Remedial action objectives cannot be achieved.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.
Long-Term Effectiveness	Contaminants may continue to migrate and possibly impact downgradient receptors including Carmans River at 5-15 ppb. Health risks have been minimized through institutional controls like public water hookups Since no long term monitoring and modeling are available, long-term effectiveness cannot be ensured.	Significant contaminant removal from the aquifer through on/off site IRAs and source control. Long term monitoring and modeling will verify long-term effectiveness.	Significant contaminant removal from the aquifer through on/off site IRAs and source control. Long term monitoring and modeling will verify long-term effectiveness	Significant contaminant removal from the aquifer through on/off site IRAs and source control. Long term monitoring and modeling will verify long-term effectiveness	Significant contaminant removal from the aquifer through on/off site IRAs and source control. Long term monitoring and modeling will verify long-term effectiveness	Significant contaminant removal from the aquifer through on/off site IRAs and source control. Long term monitoring and modeling will verify long-term effectiveness	Significant contaminant removal from the aquifer through on/off site IRAs and source control. Long term monitoring and modeling will verify long-term effectiveness
Reduction of Toxicity, Mobility and Volume	No direct reduction of contaminant toxicity, mobility or volume since no treatment is involved. Plume migrates down to Sunrise Highway at concentrations up to 50 ppb. Significant plume migration occurs offsite in this alternative.	Natural attenuation does result in reduction of contaminants through naturally occurring means, but the process is slow. Plume migrates down to Sunrise Highway at concentrations up to 50 ppb. Significant plume migration occurs offsite in this alternative.	Significant contaminants removed from aquifer. MCLs are reached in Upper Glacial in slightly over 30 years. Plume migration down to Brookhaven Airport (6,000 feet).	Significant contaminants removed from aquifer. MCLs are reached in Upper Glacial in 30 years. Alternative meets RAOs for plume growth and cleanup of Upper Glacial within 30 years.	Significant contaminants removed from aquifer. MCLs are reached in Upper Glacial in 30 years. Alternative meets RAOs for plume growth and and cleanup of Upper Glacial within 30 years.	Significant contaminants removed from aquifer. MCLs are reached in Upper Glacial in slightly over 30 years.	Significant contaminants removed from aquifer. MCLs are reached in Upper Glacial in 30 years. Alternative meets RAOs for plume growth and and cleanup of Upper Glacial within 30 years.
Implementability	No technical difficulties will be experienced.	No major construction involved. Construction of off-site IRA and source removal system should pose no difficulties.	Requires the installation of wells in residential areas (LIPA, North St.). Requires access for installation of North Street East wells on private property.	Requires the installation of wells in residential areas (LIPA, North St.). Requires access for installation of North Street East wells on private property.	Requires the installation of wells in residential areas (LIPA, North St.). Requires access for installation of North Street East wells on private property.	Requires access for installation of North Street East wells on private property. Less difficult to implement due to the lack of wells in residential areas.	Requires the installation of wells in residential areas (LIPA, North St.). Requires access for installation of North Street East wells on private property. Requires the installation of piping throughout residential neighborhood. Requires installation of piping under the Long Island Expressway and railroad tracks.
Cost - Capital/ Total Present Worth	$0.00/$0.00	$1,697,000/$11,786,000	$10,814,000/$25,598,000	$9,728,000/$23,880,000	$10,513,000/$25,142,000	$9,142,000/$23,615,000	$8,261,000/$25,056,000
Compliance with ARARs	Chemical specific ARARS will not be achieved.	ARARS will not be achieved in 30 years in the aquifer.	ARARS will not be achieved in 30 years because MCLs will still be exceeded at small areas near the airport.	ARARS are met within Upper Glacial aquifer within 30 years.	ARARS are met within Upper Glacial aquifer within 30 years.	ARARS are met within Upper Glacial aquifer slightly after 30 years.	ARARS are met within Upper Glacial aquifer within 30 years.
Overall Protection of Human Health and the Environment	This alternative will not protect human health and the environment. Possible receptors to be impacted by the VOC plume include the Carmans River. Risks have been minimized through public water hookups	The IRAs provide for the protection of human health and the environment by capturing the high-level VOCs on- and off-site. The source removal will prevent any further deterioration of the aquifer. VOCs will continue to migrate and impact the Carmans River within 30 years, but at low levels (5-15 ppb). Contaminants will continue migrating off-site, down to Sunrise Highway at concentrations exceeding 50 ppb.	Will protect human health and the environment through contaminant reduction both on- and off-site. Further plume migration and discharges to the Carmans River are reduced. MCLs are reached in the Upper Glacial aquifer in slightly over 30 years.	Will protect human health and the environment through contaminant reduction both on- and off-site. MCLs are reached in the Upper Glacial aquifer in 30 years.	Will protect human health and the environment through contaminant reduction both on- and off-site. Further plume migration and discharges to the Carmans River are reduced. MCLs are reached in the Upper Glacial aquifer in 30 years. Low level VOC migration and discharge to the Carmans River has been reduced.	Will assist in protection of human health and the environment through contaminant reduction both on- and off-site. MCLs are reached in the Upper Glacial aquifer in slightly over 30 years. Provides for less protection against plume growth and migration but easier to implement due to no wells located in residential areas.	Will assist in protection of human health and the environment through contaminant reduction both on- and off-site. MCLs are reached in the Upper Glacial aquifer in 30 years.
State Acceptance					General State acceptance.		
Community Acceptance					General community acceptance. See the Responsiveness Summary in this document for more details.		

Table 18: Summary of Comparative Analysis of Strontium Alternatives

Assessment Factors	S1 - No Action	S2 - Natural Attenuation		S4 - In-situ Precipitation	S5a - Groundwater Extraction/ Ion Exchange/On-site Discharge/ Natural Attenuation	S7 -Pump-andTreat at WCF/Reactive Wall at Glass Holes
Key Components	Regulatory requirements mandate the detailed evaluation of the No Action alternative.	Reduction of contaminants through natural means. Public awareness program and long-term monitoring. Installation of additional monitoring wells to monitor the degradation of the strontium-90 plume. Institutional controls.		Immobilize Sr-90 by the injection of sodium phosphate and lime to precipitate the Sr-90 from groundwater. Institutional controls.	Installation of a Groundwater Extraction/Ion Exchange system to capture Sr-90 plumes at WCF/PFS and Chemical Holes and discharge to on-site recharge basins.	Installation of a two-well extraction system, treatment via ion exchange, and discharge to a basin for the WCF/PFS Sr-90 plume. Installation of a barrier wall at the Chemical Holes to prevent migration of Sr-90. Institutional controls.
Short-Term Effectiveness	No impacts.	Potential risks to workers during drilling of monitoring wells, material handling and sampling activities.		Potential risks to workers during drilling of injection wells, material handling and sampling activities.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.
Long-Term Effectiveness	Cannot verify the long-term effectiveness without long-term monitoring and modeling. Strontium present in aquifer above MCLs beyond 30 years.	Minimal migration expected due to low mobility in aquifer Long-term effectiveness is verified by long term monitoring and modeling results.		Reduces the migration of Sr-90 within the aquifer. However, due to low mobility and flat gradient at Chemical Holes, Sr-90 migrates very little under natural attenuation conditions. Effective for the Chemical Holes area, preventing migration of the plume.	Complete treatment after 25-30 years of treatment down to MCLs at WCF/PFS. Complete treatment at Chemical Holes after 10 years. Rad waste from the ion exchange system will need to be disposed of.	Complete treatment after 25-30 years of treatment down to MCLs at WCF/PFS. Complete treatment at Chemical Holes after 10 years. Rad waste from the ion exchange system will need to be disposed of. Sr-90 at Chemical Holes allowed to decay in-situ without any plume migration.
Reduction of Toxicity, Mobility and Volume	No direct reduction since no treatment is involved.	Natural attenuation results in reduction of toxicity and volume without significant migration.		Mobility of the strontium-90 is reduced by the precipitation of the strontium-90. Radio-active decay will reduce toxicity and volume.	A permanent reduction down to the 8 pCi/l MCL is achieved at all areas after 25-30 years resulting in the reduction of toxicity. Mobility and plume growth is reduced at the Chemical Holes area.	A permanent reduction down to the 8 pCi/l MCL is achieved at all areas after 25-30 years resulting in the reduction of toxicity. Mobility and plume growth is reduced at the Chemical Holes area.
Implementability	No technical difficulties will be experienced.	No major construction involved. Requires monitoring which can be easily implemented.		Drilling contractors readily available. Injection wells are shallow wells. A pilot study is required for final design. Sampling for treatment effectiveness and groundwater monitoring can be implemented.	Treatment equipment readily available. A treatability study is required for final design. Sampling for treatment effectiveness and groundwater monitoring can be implemented.	Pump and treat equipment readily available and implementable. Reactive wall may be difficult to install.
Cost - Capital/ Total Present Worth	$0.00/$0.00	$157,000/$949,000		$1,040,000/$2,001,000	$1,552,000/$5,840,000	$2,191,000/$6,011,000
Compliance with ARARs	Groundwater quality ARARS are not achieved at the Chemical Holes, WCF and BGRR in 30 years.	Groundwater quality ARARS are not achieved at the Chemical Holes, WCF and BGRR in 30 years. RAOs are not met as Sr-90 exceeds MCLs after 30 years.		Groundwater quality ARARS may be met as Sr-90 is removed from the groundwater into the soil matrix, but not removed from the environment.	Chemical-specific ARARS of 8 pCi/l are reached at all locations within 25-30 years. Treated discharge will comply with action-specific ARARs. Ion exchange is a proven technology for Sr-90 removal.	Chemical-specific ARARS of 8 pCi/l are reached at all locations within 25-30 years. Reactive wall will remove Sr-90 down to below MCLs as water passes through for approximately 30 years. Sr-90 remains in ground beyond 30 years as it decays
Overall Protection of Human Health and the Environment	Does not insure	Provides for protection of human health through public awareness programs, land-use controls, and on-site monitoring.		This alternative is protective of human health and the environment as Sr-90 is treated in-situ without the potential exposure to Sr-90 associated with ex-situ alternatives.	This alternative will protect human health and the environment through contaminant reduction, and minimize further migration of Sr-90. Potential exposure to Sr-90 will increase due to O&M activities for the treatment systems and the management, transportation and disposal of residual waste.	Potential exposure to Sr-90 has increased in this alternative due to O&M activities for the treatment systems and the management, transportation and disposal of residual waste. Risks would be reduced as a result of less teatment at the Chemical Holes.
State Acceptance					General State acceptance.	
Community Acceptance					General community acceptance. See the Responsiveness Summary in this document for more details.	

Table 19: Summary of Comparative Analysis of Tritium Alternatives

Assessment Factors	T1 - No Action	T2 - Natural Attenuation	T3 - Natural Attenuation with Tritium IRA System	T4 - Contingency Based Remediation	T5 - Extraction/ Recirculation	T6 - Hot Spot Removal/ On-Site Storage	T7 - Hot Spot Removal/ Off-Site Evaporation T8 - Hot Spot Removal/ On-Site Evaporation
Key Components	Regulatory requirements mandate detailed evaluation of the No Action alternative.	Reduction of contaminants through naturally occurring means with the existing Tritium IRA in standby. Groundwater monitoring.	Reduction of contaminants through naturally occurring means with the existing Tritium IRA. Groundwater monitoring.	Contingency based remediation if tritium concentrations exceed 2,000,000 pCi/l at the reactor, or if tritium exceeds 25,000 pCi/l at the Chilled Water Plant Road and/or 20,000 pCi/l at Weaver Drive. Remediation based on reactivation of IRA system or start-up of 10 extraction well low flow pumping systems with off-site disposal.	Installation of four extraction wells to contain the 20,000 pCi/l tritium concentrations. Extracted water will have TVOCs removed via air stripper and discharged to RA-V recharge basins. Tritium IRA in standby. Groundwater monitoring.	Contain the highest tritium concentrations with two low flow extraction wells pumping for one year. Extracted water will be stored in an on-site storage tank for 50 years. Tritium IRA in standby. Groundwater monitoring.	Both alternatives contain the highest tritium concentrations with two low flow extraction wells pumping for one year. **T7-** Extracted water will be disposed of off-site by evaporation. **T8-** Extracted water will be disposed of on-site by evaporation. Tritium IRA in standby. Groundwater monitoring.
Short-Term Effectiveness	This alternative would provide for short-term protection of human health and the environment. Remedial action objectives cannot be achieved.	Possible risk to workers exists through dermal contact.	Possible risk to workers exists through dermal contact.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.	Potential risk to workers through dermal contact and inhalation.
Long-Term Effectiveness	Long-term effectiveness cannot be verified without long-term monitoring and modeling results.	Tritium plume size and levels will decrease to below MCLs within 20-25 years. Plume does not significantly migrate. No long-term exposure to residuals.	Tritium plume size and levels will decrease to below MCLs within 20-25 years. Plume does not significantly migrate. No advantage to the operation of the IRA system. No long-term exposure to residuals. Carbon for the treatment of VOCs can be regenerated and re-used.	Tritium plume size and levels will decrease to below MCLs within 20-25 years. Plume does not significantly migrate. No long-term exposure to residuals. Carbon for the treatment of VOCs can be regenerated and re-used.	Tritium plume size and levels will decrease to below MCLs within 15-20 years. Plume does not migrate off site. No long-term exposure to residuals.	Tritium plume size and levels will decrease to below MCLs within 20 years. Plume does not migrate off site. Possible exposure to stored tritium for up to 50 years.	Tritium plume size and levels will decrease to below MCLs within 20 years. Plume does not migrate off site. Possible off-site exposure to evaporated tritium, below air discharge limits.
Reduction of Toxicity, Mobility and Volume	Some reduction of tritium achieved, but cannot be evaluated without monitoring and modeling results.	Tritium concentrations are reduced to be below MCL concentrations within 20-25 years. Further groundwater sampling and modeling will confirm the rate of attenuation.	Tritium concentrations are reduced to below MCL concentrations within 20-25 years. Further groundwater sampling and modeling will confirm the rate of attenuation.	This alternative offers additional protection from plume migration. Tritium concentrations are reduced to below MCL concentrations within 20-25 years. Further groundwater sampling and modeling will confirm the rate of attenuation.	Tritium concentrations are reduced to below MCL concentrations within 15-20 years. Further groundwater sampling and modeling will confirm the rate of attenuation. No great reduction in migration when compared to T2.	Tritium concentrations are reduced to below MCL concentrations within 20 years. Further groundwater sampling and modeling will confirm the rate of attenuation. No great reduction in migration when compared to T2.	Tritium concentrations are reduced to below MCL concentrations within 20 years. Further groundwater sampling and modeling will confirm the rate of attenuation. No great reduction in migration when compared to T2.
Implementability	No technical difficulties will be experienced.	No major construction involved. Groundwater monitoring can be easily implemented. Requires acceptance by regulatory agencies.	No major construction involved. IRA system is currently in operation. Groundwater monitoring can be easily implemented.	No major construction involved. IRA system is currently in operation. The technologies and equipment required are readily proven and commercially available. Coordination for transportation of tritium might pose some difficulties. Groundwater monitoring can be easily implemented.	The technologies and equipment required are readily proven and commercially available. Groundwater monitoring can be easily implemented.	The technologies and equipment required are readily proven and commercially available. Groundwater monitoring can be easily implemented.	The technologies and equipment required are readily proven and commercially available. Groundwater monitoring can be easily implemented. Permitting difficulties with approvals for the discharge of tritium to the atmosphere.
Cost - Capital/ Total Present Worth	$0.00/$0.00	$0.00/$1,997,000	$0.00/$3,257,000	$456,000/$4,890,000	$853,000/$4,802,000	$1,349,000/$3,669,000	**T7-** $331,000/$26,776,000 **T8-** $628,000/$3,654,000
Compliance with ARARs	May not comply.	Complies after 20-25 years.	Complies after 20-25 years.	Complies after 20-25 years.	Complies after 15-20 years.	Complies after 20 years.	Complies after 20 years.
Overall Protection of Human Health and the Environment	May not be protective of human health and the environment.	Protective: Groundwater is reduced to below MCLs without migrating off site.	Protective: Groundwater is reduced to below MCLs without migrating off site.	Protective: Groundwater is reduced to below MCLs without migrating off site. Tritium requiring off-site evaporation will result in small exposures.	Protective: Groundwater is reduced to below MCLs without migrating off site.	Protective: Groundwater is reduced to below MCLs without migrating off site.	Protective: Groundwater is reduced to below MCLs without migrating off site. Tritium requiring on- and off-site evaporation will result in small exposures.
State Acceptance				General State acceptance.			
Community Acceptance				General community acceptance. See the Responsiveness Summary in this document for more details.			