Summary of Assumed Damages, Impacts, and Mitigation for Scenarios A, B, and C

DRAFT
SUPPLEMENTAL
ENVIRONMENTAL
IMPACT STATEMENT

Brightwater
Regional Wastewater
Treatment System

Scenario A – Summary of Assumed Damages, Impacts, and Mitigation*

Worst Case Scenario A Ground Fault Rupture at Lineament 4	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
What damage could occur to facilities?	No structural damage to water holding tanks	No structural damage to digesters or solids handling facilities	Connecting pipes to process units below ground could crack and leak	Severe damage to northern portion of StockPot building; plant operations and other personnel space may be located in southern portion of StockPot building or at the southern end of the plant site. No damage to diesel tank, or electrical substation. Potential limited damage to one or both electrical power feeds	Odor control systems and ductwork could sustain minor damage	Minor to none	Combined tunnel would remain intact and operational Pipelines in the tunnel could deform, minor internal cracks may occur but could be repaired without tunnel leaking
Where is it on-site?	Northern part of site more than 500 feet south of Lineament 4	More than 1,500 feet from Lineament 4 on southern part of site	Could be at any location on-site	StockPot building is on northern part of site Lineament 4 may be located under northern portion of Stockpot building. Satellite control rooms would be in MBR and solids buildings and future energy building, well away from Lineament 4 Diesel tank is located on southern part of site Substation is on southern part of site One power feed is along SR 9 and the other along 228th; both join at the intersection and are located on the same poles along SR 9, south of 228th to the substation	Multiple locations onsite MBR odor control (northernmost odor facility) more than 500 feet from Lineament 4	Northern building, containing alkaline chemicals, is near MBR units and more than 500 feet from Lineament 4, southern building, containing acidic chemicals, is more than 1,600 feet from Lineament 4 Chemical storage facilities separated by approximately 1,200 feet	Southern part of site, 2,400 feet from Lineament 4
What is it that leaks/spills?	No spills or leaks from tanks	No spills or leaks from digester tanks or solids handling facilities	Partially treated wastewater, small quantity of solids	No spills or leaks from buildings	Potential minor leaks would be contained within odor control buildings and storage areas	No leaks from chemical storage facilities (See Scenario B for list of chemicals)	No leaks from tunnel
What is the volume spilled /leaked or discharged?	None	None	0 to 300,000 gallons may be spilled, leaked or discharged	None	NA	NA	NA
Where does it go?	NA	NA	Small quantities could leak into surrounding soil and migrate to groundwater If underdrain system was not plugged, small amounts could reach surface waters via storm drainage system	NA	NA	NA	NA

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Worst Case Scenario A Ground Fault Rupture at Lineament 4	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
How long would it take to repair damage and restart operations?	NA	NA	Approximately 24 to 72 hours for inspection and minor repair	Operations could continue with damage to the StockPot building	Approximately 24 to 72 hours for inspection and minor repair	Approximately 24 to 72 hours for inspection and minor repair	Undamaged tunnel could be put into operation as soon as plant was ready to restart
What could it impact?	No impacts from tanks, which would not leak Off-site overflows from collection system if there were a prolonged plant shutdown during wet weather If damaged process units had to be bypassed during repair, partially treated effluent could be discharged to Puget Sound for a period of time	NA	Groundwater, ultimately Little Bear Creek in 4-5 years if unremediated Surface water and Little Bear Creek if leaked water entered underdrains and were allowed to flow offsite	NA	NA	NA	Repair of any cracks in pipelines within the tunnel would be scheduled for summer low flow periods so there would be the least risk of system overflows while Brightwater flows were transferred to the other two plants for treatment
How has it been mitigated or what mitigating measures would be implemented?	Design is to higher standard than IBC 2003 code Designed to meet ACI code requirements for crack control	Design is to higher standard than IBC 2003 code Designed to meet ACI code requirements for crack control	Piping systems designed to be flexible where they connect to structures, minimizing leak potential Manually plug underdrain system to retain wastewater in ground onsite Groundwater contamination would be remediated and contaminated soil removed Outlet from wetscapes could be plugged to prevent discharge to Little Bear Creek Contents of drains and/or wetscapes could be pumped out and removed from site	If the operations control center, administration and laboratory are located in the southern portion of the StockPot building, the building would have structural upgrades to IBC 2003 to meet Life/Safety Code The main control center could be out of operation without seriously impacting plant operations Operations control centers are redundant with at least 2 other remote control locations onsite initially and 3 when cogeneration is added in the future Other non-process facilities have been designed to IBC 2003 code	Designed to IBC 2003 to withstand strong shaking Minimize amount of chemicals stored in each building Containment areas to retain chemicals inside buildings Tanks strapped or bolted to the floor	Designed to IBC 2003 to withstand strong shaking Containment areas for chemicals inside facilities Bulk chemical storage in two separated facilities Only one pipe connection susceptible to damage below tank levels with external automatic shutoff valve Tanks strapped or bolted to the floor	Designed to minimize the possibility of damage from an earthquake Because the tunnel and ground would move simultaneously, effects of strains are less than for surface structures Design strategies include filling the annular space between the pipes with concrete grout to help minimize leakage or infiltration to cracked or broken pipes

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Scenario B – Summary of Assumed Damages, Impacts, and Mitigation*

Worst Case Scenario B Ground Fault Rupture at Lineament X	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
What damage could occur to facilities?	No structural damage to water holding tanks	No structural damage to digesters or solids handling facilities	Connecting pipes to process units below ground could crack and leak	Limited to no damage to StockPot building that may include Operations Control If operations/maintenance is located at southern end of site, impacts would be minor No damage to diesel tank, limited damage to electrical substation or electrical power feed	Odor control systems and ductwork could sustain minor damage	Minor to none	Combined tunnel would fail and pipes inside would release influent, effluent and reclaimed water
Where is it on-site?	Northern and central part of site; nearest major units are the primary clarifiers which are located approximately 1200 feet north of Lineament X	Southern part of site; digesters are located approximately 800 feet north of Lineament X; Solids building approximately 700 feet north of Lineament X	Could be at any location on-site	Limited damage to above ground buildings and non-structural elements such as equipment and electrical gear StockPot building is on northern part of site. South operations/maintenance location would be about 450 feet from Lineament X Diesel tank is located on southern part of site approximately 600 feet north of Lineament X Electrical power feed and substation is on southern part of site; substation is approximately 300 feet north of Lineament X One power feed is along SR 9 and the other along 228th; both join at the intersection and are located on the same poles along SR 9, south of 228th to the substation Structures and non-structural elements at multiple locations	Multiple locations onsite Solids building odor control (southernmost odor facility) approximately 600 feet from Lineament X	Northern building, containing alkaline chemicals, is near MBR units and approximately 1900 feet from Lineament X Southern building, containing acidic chemicals, is located near the headworks and primary odor control and is approximately 1000 feet from Lineament X. Chemical storage facilities separated by approximately 1,200 feet	Southwest corner of site, on or very near to Lineament X
What is it that leaks/spills?	No spills or leaks from tanks	No spills or leaks from digester tanks or solids handling facilities	Partially treated wastewater, small quantity of solids	No spills or leaks from buildings	Potential minor leaks would be contained within odor control buildings and storage areas	No leaks from chemical storage facilities	Influent, effluent and reclaimed water
What is the volume spilled /leaked or discharged?	None	None	0.1 to 0.3 mg from within the plant plus 440,000 gallons from damaged tunnel	None	NA	NA	Influent: 200,000 gallons Effluent: 200,000 gallons Reclaimed Water: 40,000 gallons Total: 440,000 gallons

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Worst Case Scenario B Ground Fault Rupture at Lineament X	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
Where does it go?	NA	NA	Small quantities could leak into surrounding soil and migrate to groundwater If underdrain system was not plugged, small amounts could reach surface waters via storm drainage system	NA	NA	NA	Leakage from tunnel failure would be 25 to 30 feet below ground surface Small quantities could leak into groundwater
How long would it take to repair damage and restart operations?	NA	NA	Approximately 24 to 72 hours for inspection and minor repair	Hours to days	Approximately 24 to 72 hours for inspection and minor repair	Approximately 24 to 72 hours for inspection and minor repair	King County would construct a temporary pipeline at the location of tunnel break to divert influent flows into the effluent pipeline Temporary modification could take up to 6 weeks to construct and accommodate a flow rate up to 130 mgd Up to 6 months for tunnel to be repaired
What could it impact?	No impacts from tanks, which would not leak Off-site overflows from collection system if prolonged plant shutdown	NA	Groundwater, ultimately Little Bear Creek in 4-5 years if unremediated Surface water and Little Bear Creek if leaked water entered underdrains and were allowed to overflow offsite	NA	NA	NA	Groundwater, ultimately Little Bear Creek, in 4-5 years if unremediated Until diversion to other plants (3 – 6 days) and Puget Sound (up to 6 weeks), there would be overflows to freshwater during wet weather. After Puget Sound diversion, overflows would be to Puget Sound

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Worst Case Scenario B Ground Fault Rupture at Lineament X	Liquid treatment process units (aeration basins and sedimentation tanks, MBR)	Solids process facilities (digesters & solids handling)	Connecting pipes to process units (all underground)	Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)	Odor control systems and ductwork	Bulk Chemical storage facilities	Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)
How has it been mitigated or what mitigating measures would be implemented?	Design is to higher standard than IBC 2003 code Designed to meet ACI code requirements for crack control	Design is to higher standard than IBC 2003 code Designed to meet ACI code requirements for crack control	Manually plug underdrain system to retain wastewater onsite Groundwater contamination would be remediated and contaminated soil removed Outlet from wetscapes could be plugged to prevent discharge to Little Bear Creek Contents of drains and/or wetscapes could be pumped and removed from site	Operations control center, administration and laboratory will be located in the southern portion of the StockPot building and have structural upgrades to meet IBC 2003 code for life/safety Operations control centers are redundant with at least 2 other remote control locations onsite Other non-process facilities have been designed to IBC 2003 code	Designed to IBC 2003 to withstand strong shaking Minimize amount of chemicals stored in each building Containment areas to retain chemicals inside buildings Tanks strapped or bolted to the floor	Designed to IBC 2003 to withstand strong shaking Containment areas for chemicals inside facilities Only one pipe connection subject to damage below tank levels with external automatic shutoff valve Tanks strapped or bolted to the floor	Combined tunnel designed to minimize the possibility of damage from an earthquake Because the tunnel and ground would move simultaneously, effects of strains are less than for surface structures Design strategies include filling the annular space between the pipes with concrete grout to help minimize leakage or infiltration to cracked or broken pipes Groundwater contamination would be remediated and contaminated soil removed Construction of temporary pipeline to divert influent flows into effluent pipeline and ultimately Puget Sound

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Scenario C – Summary of Assumed Damages, Impacts, and Mitigation*

Worst Case Scenario C Ground Fault Rupture at Hypothetical Location between Lineaments 4 and X	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
What damage could occur to facilities?	If fault ruptured under process units, severe damage and wide cracks would develop in several tanks resulting in leakage of contents into surrounding soil and shallow groundwater If ground fault ruptured elsewhere onsite, same as A	If fault ruptured under digester complex large cracks could develop in the tanks and contents would leak to ground surface Digester gas could be released If ground fault ruptured elsewhere onsite, same as A	Rupture under connecting (buried) pipes could leak contents into surrounding soil and groundwater If ground rupture fault was elsewhere onsite, same as A	If ground fault rupture occurred under diesel tank damaging double walled tank, diesel fuel could leak into surrounding soil and groundwater Temporary loss of power feeds if both electrical lines were down and/or failure of substation If operation and maintenance building is located at alternate at south end of the site, it could be severely damaged if a fault rupture developed under it If ground fault ruptured elsewhere on site, same as A, except StockPot not as severely damaged as in A	If ground fault rupture near or under odor control facility, extensive damage would be sustained and prevent system from operating until repairs could be made If small tanks were to crack in odor control building and contents were beyond capacity of containment, contents could spill to surface or leak into surrounding soil and groundwater (would not volatilize). If ground fault ruptured elsewhere onsite, same as A	If ground fault ruptured under chemical storage facilities, and if all storage tanks were to fail and if the containment were to crack, chemicals could spill to surface or leak into surrounding soil and groundwater (would not volatilize) If ground fault ruptured elsewhere on site, same as A	Combined tunnel would remain intact and operational. Pipelines in the tunnel could deform, minor internal crack may occur but could be repaired without tunnel leaking (Same as A)
Where is it on-site?	Hypothetical scenario assumes fault rupture could be at any location on-site under the liquid treatment units Tanks are mostly <u>below</u> ground surface	Hypothetical scenario assumes fault rupture could be at any location on-site under digestion and solids treatment Tanks are mostly <u>above</u> ground surface	Hypothetical scenario assumes fault rupture could be at any location on-site	Diesel tank is located on southern part of site and is buried underground Electrical power feed and substation is on southern part of site Power lines and substation are above ground Other non-process facilities could be at any location on-site	Buildings are at multiple locations onsite Only one of the buildings could be severely damaged due to ground rupture	Hypothetical scenario assumes that fault rupture could be at any location on-site. Chemical storage facilities separated by approximately 1,200 feet Northern facility containing alkaline chemicalsis near MBR: southern facility containing acidic chemicals is near the headworks	Southern part of site on or near Lineament X (Scenario C)

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Worst Case Scenario C Ground Fault Rupture at Hypothetical Location between Lineaments 4 and X	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
What is it that leaks/spills?	Untreated, partially treated and/or fully treated wastewater	Untreated to partially treated solids	Untreated, partially treated and/or fully treated wastewater	Diesel fuel	Sodium hypochlorite Sodium hydroxide Sulfuric acid	North Storage Facility Sodium hypochlorite Sodium hydroxide South Storage Facility Ferric chloride Polyaluminum chloride Citric acid	No leaks from tunnel
What is the volume spilled /leaked or discharged?	Between 0 and 9.4 MG depending on location and extent of damage (9.4 MG represents all 6 aeration tanks failing, highly unlikely)	0 to 4 MG (4 MG represents failure of four digesters, highly unlikely) Digester gas would be released to atmosphere causing odors	Between 500,000 gallons and 700,000 gallons may be spilled, leaked or discharged, assuming largest pipe is completely ruptured	Diesel tank holds 4,000 gallons	Each odor control facility holds: Sodium hypochlorite 300 gallons Sodium hydroxide, 300 gallons Sulfuric acid, 300 gallons	Sodium hypochlorite- 3 tanks at 18,000 gallons per tank Sodium hydroxide – 1 tank, 18,000 gallons Ferric chloride – 3 tanks at 18,000 gallons per tank Polyaluminum chloride – 1 tank at 10,000 gallons Citric acid – 1 tank at 10,000 gallons Bulk storage has containment for 2 or 5 tanks	NA

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Worst Case Scenario C Ground Fault Rupture at Hypothetical Location between Lineaments 4 and X	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
Where does it go?	Mixes and flows with the groundwater towards Little Bear Creek if underdrain is plugged If underdrain system was not plugged, small amounts could reach surface waters via storm drainage system through wetscapes Pumps put in place to bypass damaged basins would divert untrated or partially treated flows around the basins to Puget Sound via the effluent tunnel	Solids discharge rapidly from tanks (within a few minutes); spreads across much of southern part of Route 9 site, and some flows downhill to west boundary, across SR-9 at intersection of 233rd St, and beyond, into Little Bear Creek; Howell Creek would also be impacted Some escaping solids flow to southern-most of three stormwater canals where they would be detained for a short period of time, released to the treatment wetlands at the southern end of the site (South Wetscape), then pass through Howell Creek culvert under SR-9 to Little Bear Creek From Little Bear Creek would flow to confluence with Sammamish River During the repair period, solids would be trucked to other treatment plants for processing Digester gas would be released No discharge of solids to Puget Sound	Could mix with groundwater and flow towards Little Bear Creek.	If tank is ruptured, diesel fuel could infiltrate to groundwater and flow towards Little Bear Creek if unremediated	Stormwater drainage system if amount exceeds containment capacity and contents leak to surface If containment is damaged, contents could leak into surrounding soil and mix and flow with groundwater towards Little Bear Creek	Stormwater drainage system if amount exceeded containment capacity and contents leaked to surface Alkaline chemicals stored on north end of site would flow to North Roadway Runoff Canal. Acidic chemicals stored at south end of site drain would flow to South Road Runoff Canal. If storm drainage system is plugged, or containment is damaged, chemicals would seep into the surrounding soil and could mix and flow with groundwater towards Little Bear Creek	NA

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Worst Case Scenario C Ground Fault Rupture at Hypothetical Location between Lineaments 4 and X	**Liquid treatment process units (aeration basins and sedimentation tanks, MBR)**	**Solids process facilities (digesters & solids handling)**	**Connecting pipes to process units (all underground)**	**Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)**	**Odor control systems and ductwork**	**Bulk Chemical storage facilities**	**Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)**
How long would it take to repair damage and restart operations?	One week to set up portable pumps to bypass damaged tanks to combined tunnel resulting in untreated to partially treated wastewater discharge to Puget Sound Timing would be dependent on condition of roads in region for pump delivery Repair of damaged tanks could take between 2 months and 1 year depending on damage Partial treatment would resume in 2 months Full treatment would resume in 6 months to 1 year	One week of plant shutdown for inspection and to set up portable pumps to bypass solids handling Repair of solids handling could take up to one year	24 to 72 hours for inspection and minor repair If severe damage to connecting pipes, could take between 2 and 6 months to repair	If diesel tank were severely damaged, could take up to 2 months to repair If substation were severely damaged, could take up to 6 months to repair Power lines would be repaired within 72 hours Note that repair times for substations and power lines would be dependent on regional need and SnoPud's priorities Operations/maintenance buildings at south location would take 6-12 months to repair/rebuild. The plant could be operated from one of the satellite facilities during that time	24 to 72 hours for inspection and minor repair If odor control facility was severely damaged, could take up to 6 months to repair	From a few days to months depending on the extent of the damage	Undamaged tunnel could be put back in operation as soon as treatment plant was ready to begin partial operations
What could it impact?	Soils and groundwater. Little Bear Creek in 12-15 years if not remediated Stormwater system/Wetscapes if underdrain not plugged	Stormwater system/ Wetscapes, Howell Creek, Little Bear Creek; SR-9 Air resources onsite (odors)	Soils and groundwater Little Bear Creek in 4-5 years if not remediated	Soils and groundwater and Little Bear Creek if not remediated	Air resources from odor as a result of damaged odor control facility Potentially soil and groundwater if containment building failed	Soils and groundwater and Little Bear Creek in 4-5 years if not remediated	Repair of any cracks in pipelines within the tunnel would be scheduled for summer low flow periods so there would be the least risk of system overflows while Brightwater flows were transferred to the other two plants for treatment

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Worst Case Scenario C Ground Fault Rupture at Hypothetical Location between Lineaments 4 and X	Liquid treatment process units (aeration basins and sedimentation tanks, MBR)	Solids process facilities (digesters & solids handling)	Connecting pipes to process units (all underground)	Non-process facilities (diesel tank, StockPot building, electrical, operations & maintenance)	Odor control systems and ductwork	Bulk Chemical storage facilities	Combined tunnel (including influent, effluent & reclaimed water pipes (force mains)
How has it been mitigated or what mitigating measures would be implemented?	Groundwater contamination would be remediated and contaminated soil removed. Tank design is to higher standard than IBC 2003 code Designed to meet ACI code requirements for crack control Portable motor driven pumps delivered to Brightwater to bypass damaged units Damaged tanks would be pumped out to prevent further leakage Isolation valves between all tankage Manually plugging underdrain system and pump out to prevent further infiltration Plug storm drains and storm drain piping to contain leaks on-site and allow clean-up prior to reaching wetscapes, Howell Creek, or Little Bear Creek	Design is to higher standard than IBC 2003 code Designed to meet ACI code requirements for crack control Plugging Wetscape to keep some solids onsite. Clean up of materials as quickly as possible, soil remediation where necessary Post contamination notification at overflow locations Remove solids with eductor truck and wash down ground Pump out remaining solids areas and truck to other treatment plants for processing Digesters are designed to minimize quantity of digester gas contained onsite which reduces odor potential if gas escapes. Plug storm drains and storm drain piping to contain leaks on-site and allow clean-up prior to reaching wetscapes, Howell Creek, or Little Bear Creek	Piping systems designed to be flexible where they connect to structures minimizing leak potential Groundwater contamination would be remediated and contaminated soil removed.	Groundwater contamination would be remediated and contaminated soil removed. Temporary power would be available with portable generators brought to the site, could run on generators until Sno-Pud could repair damage. Essential service power supply (UPS) provided for life/safety needs on site Satellite control centers could be used if main control were damaged Diesel tank has double-walled construction, all pipes and fillings are located at top of tank	Containment provided around tanks and enclosed building provided to house the chemicals and equipment Containment and buildings designed to IBC 2003 to withstand strong shaking Tanks strapped or bolted to floor	Facilities separated by 1,200 feet to prevent chemicals from mixing Designed to IBC 2003 to withstand strong shaking Containment areas for chemicals Only one pipe connection subject to damage below tank levels with external automatic shutoff valve Tanks strapped or bolted to floor Groundwater contamination would be remediated and contaminated soil removed.	Combined tunnel designed to minimize the possibility of damage from an earthquake Because the tunnel and ground would move simultaneously, effects of strains are less than for surface structures Design strategies include filling the annular space between the pipes with concrete grout to help minimize leakage or infiltration to cracked or broken pipes

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