



Using a Risk-Based Approach to Achieve Net Environmental Benefit During Derailment Remediation

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→ RemTech 2022

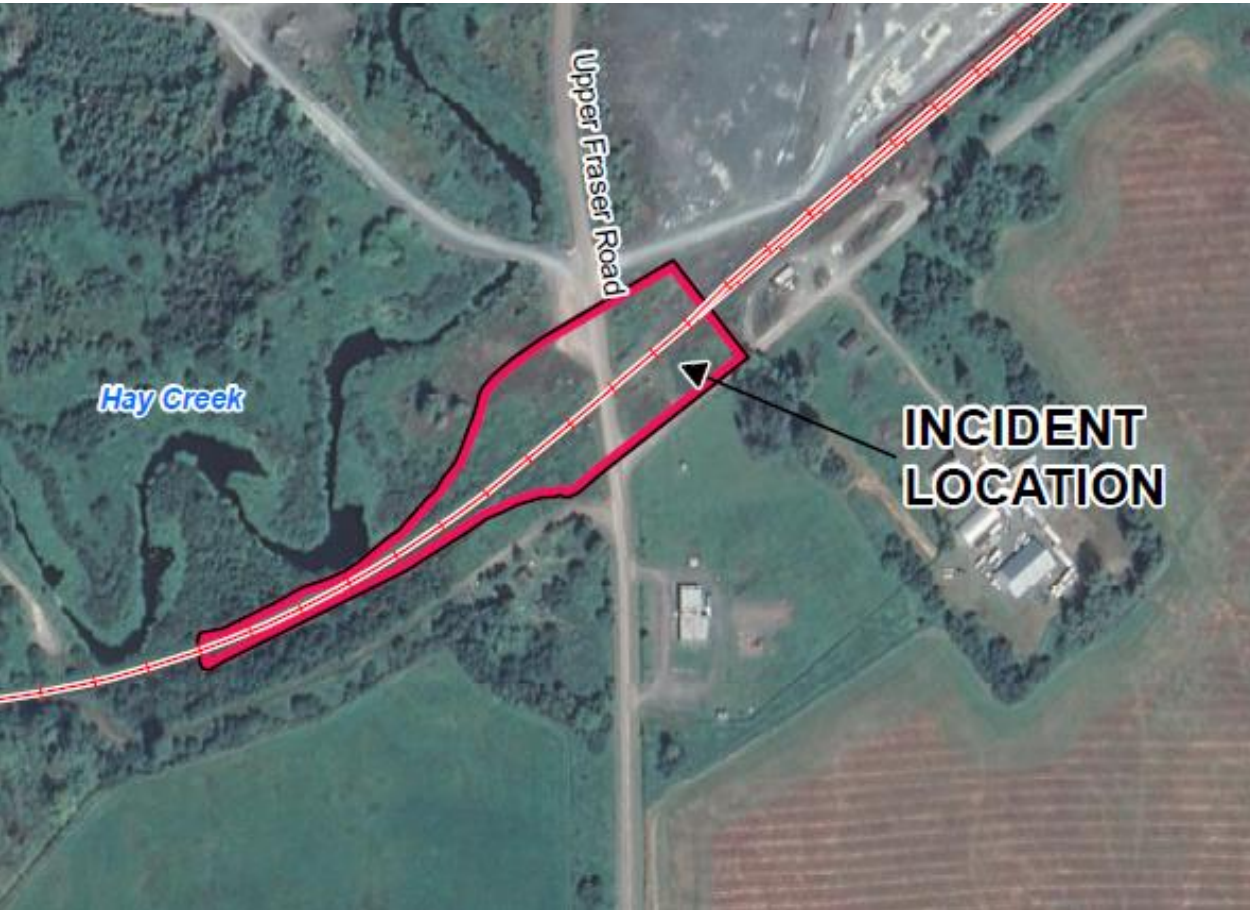


Agenda

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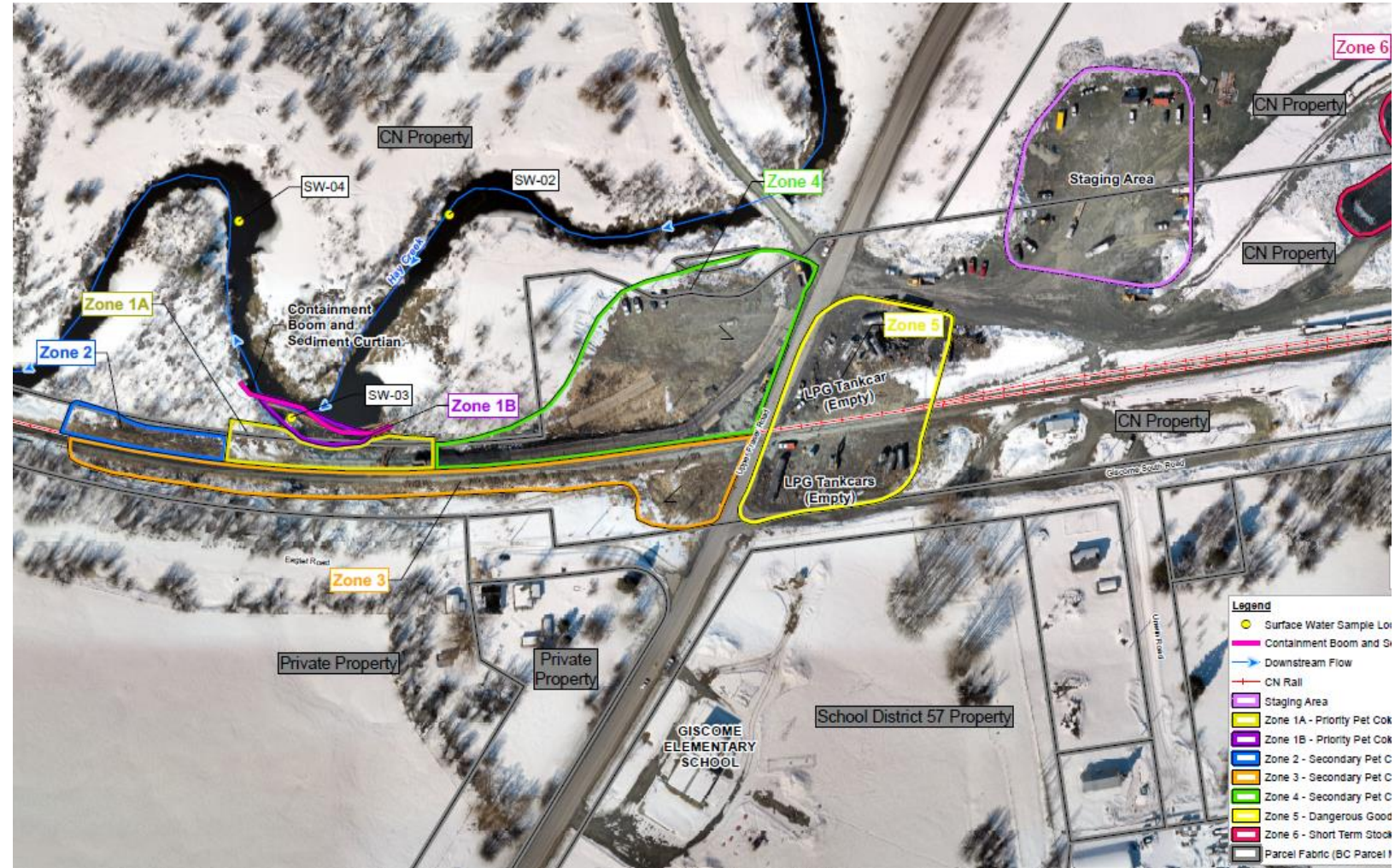
Introduction



- Incident occurred March 5, 2020, at Mile 122.4 of the CN Fraser Subdivision near Giscome, British Columbia
- Train derailment involved 20 railcars containing petroleum coke (pet coke), seven tank cars containing liquefied propane gas (LPG), and one tank car containing methanol
- Five railcars containing pet coke derailed onto the shoreline embankment of Hay Creek (Creek), resulting in the release of 50 to 100 tonnes of pet coke to the Creek
- Remaining 15 railcars derailed and released pet coke to the ground
- One LPG tank car sustained minor damage resulting in a leak

Site Setting and Receptors

- Site consists of ~400 m of the CN ROW, adjacent CN-owned land and the Creek to the north
- Creek flows west towards Fraser River
- Topography of the Site is primarily flat
- Potential receptors:
 - Nearest surface water intake over 10 km downstream
 - Three groundwater wells within 200 m
 - Giscome Elementary and two private residences located immediately south
 - Aquatic life in the Creek including benthic community, avian and mammalian wildlife that forage on benthic organisms, aquatic plants, and fish in the Creek





AS-02
5
Upper Fraser Rd

Initial Response

- CN mobilized response contractors and consultants to the Site upon notification of the Incident
- Methanol car was re-railed, no leaks
- LPG cars were repositioned adjacent to the roadway and LPG transfers were conducted
- Pet coke railcars were sheared and stockpiled in a staging area
- Recovered pet coke was stockpiled within CN property
- Pet coke on the Creek shoreline was stabilized using an excavator
- A containment boom and silt curtain were installed in the Creek to isolate the pet coke
- Real-time air monitoring and integrated air sampling activities were conducted

Product Description

Pet Coke

- Black
- Carbon-rich solid material derived from oil refining (heaviest portions of crude oil)
- Not expected to demonstrate chronic toxicity to aquatic organisms but could have a smothering effect on Creek bed
- Will be persistent in the environment but unlikely to bioaccumulate



Pet Coke Recovery from Ground

- Contractors removed bulk pet coke and pet coke impacted snow using excavators
- Bulk pet coke recovery in Zones 1, 2, 3, and 4 was completed to the extent practical
- Residual pet coke was recovered using mini excavators, vacuum trucks, and hand tools
- Pet coke containment measures were put in place along the Creek shoreline
 - Floating platform “*Aquatic Custom Dynamic Containment*” aka *ACDC*
 - Silt fencing, plywood sheeting, and polyethylene sheeting along the embankment



Pet Coke Recovery from Creek

- Containment boom and silt curtain were installed in the Creek to isolate the Source Area
- In-water investigations were conducted to determine extent of pet coke:
 - Underwater remotely operated vehicle (ROV) for visual inspection
 - Ponar for sediment grab sampling
- Majority of the pet coke settled adjacent to the south Creek shoreline
 - 270 m² of bulk (>10% pet coke in sediment)
 - 300 m² of trace (<10% pet coke in sediment)
- Trace pet coke was not recoverable without substantially disturbing aquatic habitats



Pet Coke Recovery from Creek



- An excavator was used to recover bulk pet coke from the Creek
- Minimized disturbance to Creek sediments, aquatic habitats, benthic organisms, and organic content, to achieve the greatest net environmental benefit
- Mitigation measures:
 - Dividing work into five separate cells by installing silt curtains
 - Turbidity monitoring at downstream locations



Surface Water Investigation

- Sampled along 9.5 km of the Creek
- Grab sampling for chemical analysis and concurrent monitoring of field parameters
 - PHC, VOC, SVOC, total and dissolved metals, pH, TOC, hardness, DOC, TSS
- Five primary sampling locations to determine water quality in the Creek (two upstream, one Source Area, two downstream)
- If the water depth was 1.5 m or more, stratified samples were collected
- If the water depth was less than 1.5 m, one shallow sample was collected

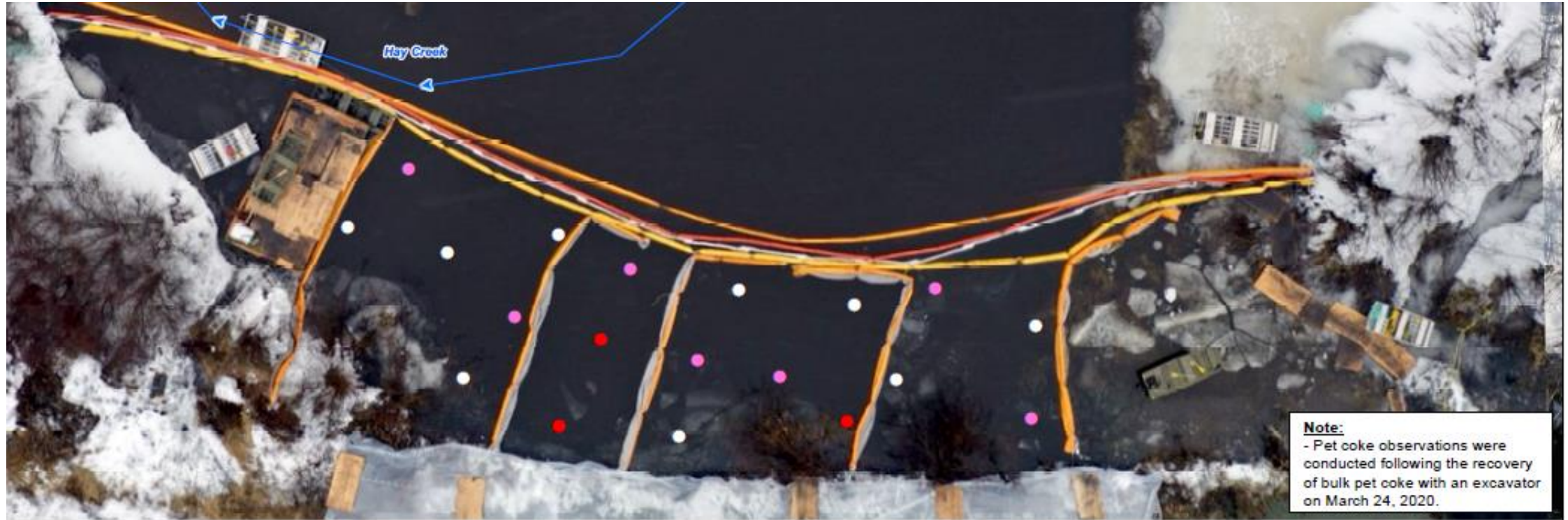


Surface Water Investigation



Sediment Investigation

Following recovery work, sediment grab sampling was completed to visually delineate the extent of residual pet coke in the area. It was determined that majority of the bulk pet coke had been removed during the in-Creek recovery.



data, all rights reserved. National Road Network 2.0 GeoBase. Atlas 2017. ESRI Base Data, 2008. Image Source: Captured On-Site by GHD; Image Acquisition Date: 3/25/2020.

Legend

- Pet Coke Observed
- Trace Pet Coke Observed
- No Pet Coke Observed
- ← Flow Direction



CANADIAN NATIONAL RAILWAY
FRASER SUBDIVISION - MP 122.4
GISCOME, BRITISH COLUMBIA
SEDIMENT DELINEATION
VISUAL OBSERVATIONS MARCH 24, 2020

11210517
Jul 24, 2020

FIGURE 2

Sediment Investigation

Pet Coke



Trace Pet Coke



No Pet Coke



Sediment Investigation

- Grab sampling for delineation and chemical analysis
 - BTEX, PAH, TOC, and grain size
- Seventeen sampling locations were selected in a grid like pattern, targeting the Source Area, trace pet coke area, as well as upstream and downstream areas of the Creek
- Samples were collected using a AMS Multi-Stage Sediment Sampling Kit or Ponar
- Three sample locations could not be sampled due to excessive organic material



Site Challenges

- Extreme cold weather and winter conditions were encountered throughout sampling programs, leading to persistent ice coverage of portions of the Creek
 - Sampling locations could not be established in areas with thick ice
- Substrate encountered during sediment delineation and sampling varied spatially throughout the Creek
 - Very hard clay and/or dense organic material could not be sampled
- COVID-19 pandemic
 - March 5, 2020 – Derailment occurred, began recovery
 - March 31, 2020 – Started sediment sampling





Ecological Risk Assessment

→ Achieving Net Environmental Benefit

Purpose of ERA

- GHD implemented surface water and sediment sampling programs to delineate pet coke impacts and evaluate surface water quality in the Creek
- Based on preliminary screening of results, concentrations of select COCs exceeded one or more of the applicable regulatory standards and guidelines in both surface water and sediment
- Surface water and sediment exceedances were evaluated further in the ERA to determine if concentrations of COCs resulted in a risk to the aquatic environment in the Creek



Creek Environmental Management Goals

- Confirm that the pet coke released to the Creek was removed to the extent practicable
- Confirm that the residual concentrations of COCs attributable to pet coke in sediment and surface water do not pose unacceptable risk to aquatic receptors and avian and mammalian wildlife
- Assess the net environmental benefit of additional recovery actions relative to possible detrimental effects of such actions on the Creek ecosystem



Regulatory Context

- Sediment and surface water investigations were conducted in alignment with BC and Canadian guidance for completing contaminated sediment assessment and ecological risk assessment
- To the extent possible, guidance and ecological screening benchmarks recognized by Provincial and Federal regulators (BC ENV, ECCC, CCME) were used in the ERA.
- If screening benchmarks were not available from Canadian-based agencies, other sources, such as the United States Environmental Protection Agency (US EPA) and the Netherlands Environmental Assessment Agency were consulted.



Analysis

- Preliminary list of COCs related to pet coke was developed based on the product SDS and a literature review
- Surface water samples analyzed for full list during initial response, continued for consistency
- COC list was refined prior to sediment sampling as data became available
 - Removed COCs not exceeding screening benchmarks in product sample (whole pet coke and leachate)
 - Removed COCs not exceeding screening benchmarks in surface water samples to date

Preliminary List	Refined List (Sediment Only)
PHC	-
VOC incl. BTEX	BTEX
SVOC inc. PAH	PAH
Total and dissolved metals	-
pH	-
TOC	TOC
DOC	-
TSS	-
-	Grain size

Sediment Risk Characterization

Risk to benthic organisms was evaluated using a three-tiered approach.

- Tier 1: Compare concentration of each COC to it's lower tier screening benchmark, below which risk to benthic organisms are not expected
- Tier 2: Compare concentration to less conservative upper tier screening benchmark, above which risk to benthic organisms is likely
- Tier 3: Calculation of sample-specific Equilibrium Sediment Benchmark Toxicity Units (ESBTUs)
 - Accounts for narcosis as the mode of ecotoxicity, sample-specific bioavailability, and exposure to pore water
 - ESBTUs sum toxicity of all narcotic organic constituents to provide a more robust estimate of overall risk
 - Based on guidance from US EPA is accepted under existing provincial and federal ERA frameworks



Sediment Risk Results

- Tier 1 and Tier 2
 - Identified potential risk posed by toluene and eight PAHs.
 - Tier 1 and 2 sediment screening benchmark are generic and do not account for a specific mode of ecotoxicity, bioavailability, or sediment pore water as the exposure medium.
- Tier 3
 - Total ESBTUs (the sum of ESBTUs for all BTEX constituents and individual PAHs) were less than the threshold value of 1 for all sediment samples

Therefore, residual concentrations of BTEX and PAHs in sediment in the Creek do not pose risk to benthic organisms



Surface Water Risk Characterization

- Risk to aquatic life was evaluated using a two-tiered approach.
 - Tier 1: Compare 95 percent Upper Confidence Limit (UCL) concentration of each COC to its water quality screening benchmark
 - Tier 2: Compare to background concentrations collected 1.5 km upstream and to the leachate results from the pet coke sample



Surface Water Risk Results

- Tier 1
 - Zinc (dissolved) and two PAHs are the only constituents potentially attributable to pet coke that exceeded their screening benchmarks
 - Two PAHs 95% UCL were below screening benchmarks
- Tier 2
 - Zinc (dissolved) exceeded screening benchmarks 50 m upstream and 8 km downstream of the Source Area but not in the Source Area
 - Zinc was not detected in the pet coke leachate
 - Therefore, likely due to natural or other sources unrelated to the derailment
- PHCs detected in limited number of samples. Screening benchmarks for PHCs not available. PHCs are not expected to pose risk to aquatic life because they were not detected in leachate from pet coke, detections were only observed before in-Creek recovery was complete, and they are not expected to be toxic due to low solubility.

Therefore, none of the constituents potentially attributable to pet coke poses risk to aquatic life in surface water of the Creek





Conclusions

Residual concentrations of constituents in sediment and surface water attributable to pet coke do not pose unacceptable risk above the threshold for concern to benthic organisms or aquatic life, or mammalian and avian wildlife that forage in the Creek.

Additional recovery actions or remedial measures would have limited benefit compared to the detrimental effects to the aquatic habitats and are not warranted.





Acknowledgements

→ Thank you to:

CN Rail - Mike Linder, Regional Manager Environment, Western Canada Field Operations

John Hunter Co. Ltd.

Nucor Environmental Solutions Ltd.

Ram Environmental Response

Triton Environmental Consultants Ltd.



Q&A

