

Memorandum

February 20, 2026

To: Caroline Jalanti, NYSDEC

From: Tim DiGiulio, Betsy Henry, Tim Johnson, and Sarah LaRoe - Anchor QEA; Jeff Caputi, Brown and Caldwell

cc: Kerry Maloney, NYSDEC; Tony Perretta, NYSDOH; Seth Levine, Nepera, Inc.; Eric Gaulin, Warner-Lambert Company, LLC; Matt Robinson, ELT Harriman

Re: Technical Memorandum on Mercury Speciation and Applicable Soil Cleanup Objectives, Nepera Harriman Site No. 336006

Introduction

This memorandum has been developed to support the application of the mercury Soil Cleanup Objective (SCO) for inorganic salts as provided for in the Technical Support Document supporting the promulgation of 6 NYCRR 375. Included in this memorandum is the relevant information associated with the determination of the applicable mercury SCO for the Nepera Harriman Site (Site) in Harriman, New York (Site 336006).

Based on historical operations at the facility, and consistent with the analytical data collected over decades of investigation at the property, the mercury present at the Site is in the form of mercury salts and not elemental mercury. Based on the current zoning for the property as commercial, as well as the reasonably anticipated future use of commercial/industrial, the SCO for inorganic mercury salts of 53 milligrams per kilogram (mg/kg) based on New York State Department of Environmental Conservation (NYSDEC) regulations would be appropriate for use at this Site.

It is requested that NYSDEC confirm the applicable SCO of 53 mg/kg for this Site is based on inorganic mercury salts. Upon receipt of NYSDEC's determination on the applicable SCO for mercury, the three Feasibility Studies (Area 1 – Parking Lot, Area 2 – Lagoon and Floodplain, Area 3 - Main Plant) can be advanced to address the remedial requirements for the Nepera Harriman Site.

The following sections of this memorandum summarize the operational history and existing evidence supporting the presence of mercury salts, not elemental mercury. In addition to historical information, two reports that support this conclusion have been attached to this memorandum. The *Parking Lot (Area 1) Data Gap Study Report* (Attachment 1) describes data collected in 2024 in support of a Feasibility Study and future remedial design in this portion of the Site. The work plan for this study was submitted to NYSDEC and approved in March 2024, and the field work was completed later that year. The *Supplemental Groundwater Mercury Sampling Data Summary Report* (Attachment 2) presents the results of the supplemental groundwater sampling for mercury at the Site, which was advanced to collect more recent data with the most current sample collection guidance and

procedures. The work plan for this study was submitted to NYSDEC and approved in November 2025, and the data was collected at the end of last year.

Site Background

The former Nepera Harriman facility was used to manufacture fine and bulk pharmaceutical chemicals from 1942 to 2005. During that period, chemical by-products were incinerated at the Site, initially through open pit burning and subsequently in a RCRA Part B-permitted incinerator (shut down in 2005). Calcium sulfate material, used in the manufacturing processes, was disposed of in the area of the former administrative office building and parking lot (Anchor QEA, LLC and Brown and Caldwell Associates, 2025).

The wastewater lagoon, adjacent to the eastern boundary of the Site and southeast of the parking lot, was constructed in the 1960s. The lagoon had served as a settling pond for aluminum hydroxide and magnesium silicate precipitates generated during the manufacturing process. Wastewater consisting of boiler blowdown, non-contact cooling water, stormwater runoff, and treated groundwater were also discharged to the lagoon prior to the plant shutdown. All buildings and above-grade structures were demolished in 2015, and the lagoon currently stores stormwater runoff from the Site and discharges to the West Branch of the Ramapo River under an SPDES permit.

Mercury is present in waste materials and site soil in the parking lot area, lagoon area, Ramapo River floodplain and on the main plant portion of the site. Historical operations have contributed to the distribution of mercury across the site. The results demonstrate that mercury concentrations in surficial soil are highly variable with no clear pattern or discernible source (Brown and Caldwell and Cornerstone Engineering and Land Surveying, 2011). The NYSDEC previously reached this conclusion in the Environmental Indicator Determination (NYSDEC, September 22, 2005) which stated: "No inorganic trends were evident in the data; exceedances were dispersed randomly throughout the site". Locations on the Site that contain mercury will be evaluated as part of the upcoming Feasibility Studies to develop a recommendation for how to address any potential exceedances through remedial action and/or monitoring.

Speciation and Mobility of Mercury

Mercury exists in multiple forms or species in the environment, and the speciation plays a critical role in the mobility, fate and transport, and risk considerations for remedial decision making. Here, the investigation data indicate that elemental mercury is not present at the Site and that the Site soil and calcium sulfate waste are not significant sources of dissolved mercury to surrounding soils, groundwater, or surface water. As noted in the 1997 *Record of Decision* (ROD), the primary pathways by which mercury would move through the environment are via erosion of soils and particulate migration through the groundwater (NYSDEC, 1997). The following lines of evidence arising from the complete body of information and data are discussed in the following sections.

1) Knowledge of Manufacturing Process

2) Waste Characterization Results

3) Sampling Results

- a. Visual Observations from Soil Borings
- b. Groundwater Data
- c. Partitioning Coefficient Considerations
- d. TCLP Results

4) Fish Study

5) Mercury Speciation

Based on the presence of mercury in soil and waste material, it is recognized that pathways for mercury movement through the environment will be evaluated in the Feasibility Studies for the Site and addressed as part of future administrative documents for the Site remedy.

1) Knowledge of Manufacturing Process

Niacinamide production began in the 1930s when Vitamin B3 deficiency was found to be the cause of pellagra. Historical documents and process diagrams indicate that mercury was used as a catalyst during the manufacture of niacinamide, which produced a sludge composed primarily of calcium sulfate (Brown and Caldwell 2007, 2008). The chemical reactions and process diagrams associated with the production processes are included in Figures 1-3. As noted in Figure 1, the process diagrams also show traces of mercury in the form of cinnabar (mercury sulfide) in the waste stream. Mercuric sulfate (HgSO_4) has long been used as a catalyst for numerous industrial processes, including niacinamide synthesis (Lisicki et al. 2022; Shive and Glenn 1946; and Woodward et al. 1944). This confirms the statement noted in the ROD on Page 5 that the mercury present in this area exists in a highly immobile form (NYSDEC, 1997). There is no evidence that elemental mercury would have been brought onto the Site or used in any of the manufacturing processes. It is also noteworthy that USEPA reported large quantities of mercury catalyst (including mercuric sulfate) production in New Jersey, which would have provided a ready source for the Nepera facility (USEPA, 1975).

2) Waste Characterization Results

Five TCLP samples of the waste material collected in Area 1 in 2024 (Attachment 2, Table 4-2) were below the Resource Conservation and Recovery Act (RCRA) regulatory level for hazardous waste for all analytes, including mercury. This indicates that mercury is not readily leachable from the calcium sulfate waste material, even under the aggressive leaching conditions employed in this test, which are intended to mimic more severe leaching by the organic acid-rich waters typical of municipal landfills and are not representative of conditions at the Site.

3) Sampling Results

A) Visual Observations from Soil Borings

Hundreds of soil borings were completed and soil samples collected at the Site including the 1995 remedial investigation (RI; Conestoga-Rovers 1995), the 2007 *RCRA Facility Investigation Report* (RFI; Brown and Caldwell 2007a), the 2015 *Supplemental Remedial Investigation Report* (Brown and Caldwell 2015), the 2016 *Revised, Parking Lot Area Feasibility Study* (Cornerstone 2016), emerging contaminants investigations, and the *Parking Lot (Area 1) Data Gap Study Report*.

There are analytical detections of mercury in Site soils as well as calcium sulfate waste; however, no visual evidence of elemental mercury (e.g., sheen or mercury beads) was reported at any of the borings or soil samples from the Site. The data collected is consistent with the referenced operational history of the Site noted above.

B) Groundwater Data

2025 Groundwater Results

Of the 22 wells sampled for mercury in 2025 as part of the ISMP or Supplemental Groundwater Mercury Sampling programs, 20 of the 22 wells were below the NYSDEC Class GA groundwater standard of 0.7 ug/L for mercury. A summary of those results has been included in Table 1 below and discussed in the following sections.

Table 1
Most Recent Mercury Concentrations in Groundwater (2025)

Well ID	Date	Total Mercury ^b (µg/L)	Dissolved Mercury ^b (µg/L)
MW-1S	3/25/2025	0.091 U	
MW-2S	11/17/2025	0.091 U (0.091 U)	
MW-5S	11/21/2025	0.091 U	
MW-7S	11/20/2025	0.091 U	0.091 U
MW-9S	11/21/2025	0.28	0.16 J
MW-12S	11/18/2025	0.091 U	
MW-21S	11/18/2025	0.091 U	
MW-24S	3/25/2025	0.091 U	
MW-26S	11/19/2025	0.091 U	
MW-27S	11/21/2025	0.091 U	
MW-28S	11/19/2025	0.11 J	
MW-29S	11/19/2025	0.091 U	
MW-101	3/25/2025	1.5	
MW-102	3/25/2025	0.091 U (0.091 U)	
MW-106	11/19/2025	0.091 U	
MW-201	11/18/2025	0.15 J	
MW-202S	11/20/2025	14	0.35
AMW-1	11/20/2025	0.11 J	0.091 U
AMW-2	11/20/2025	0.21	
PZ-1	11/18/2025	0.091 U	
PZ-4	11/19/2025	0.091 U	
OW-6	11/17/2025	0.27 U	

Notes:

Green shading denotes values above the NYSDEC Class GA groundwater standard of 0.7 µg/L.

Laboratory qualifier and detection limit information not available for some data sources.

a. MW-32 is no longer in service but was located in the Parking Lot Area.

b. Field duplicates are presented in parentheses.

µg/L: microgram per liter

J: estimated, below the reporting limit

RI: remedial investigation

U: Below the method detection limit, value is method detection limit

Along Route 17, groundwater from well MW-9S had a mercury concentration of 0.28 µg/L, which is below the Class GA standard and may represent an upgradient background concentration for Site groundwater. The groundwater flow map shown in Figure 4 (first presented in the Phase III Emerging Contaminants Report; Anchor QEA and Brown and Caldwell Associates, 2024) shows that although some additional mounding may be present in the central part of the Site given the location of the

aquitard in this area, the flow through the unconsolidated material beneath the Site is to the north and east toward the Ramapo River. Wells MW-201 and AMW-1, which are downgradient of MW-9S but below Arden House Road and within the boundary of the former plant area, had estimated mercury concentrations of 0.15 µg/L and 0.11 µg/L, respectively, which are below the mercury concentration measured at MW-9S.

In the case of well MW-202S (14 µg/L), the two wells downgradient of MW-202S along Route 17 (AMW-2 and MW-24S) were below the Class GA standard for total mercury, indicating that the concentration is either very localized or the result of a sampling anomaly. The remainder of the groundwater samples outside the Parking Lot Area and associated calcium sulfate waste material were non-detect for total and dissolved mercury. This indicates that mercury in Site soils within the former plant area and the lagoon area is in an immobile form and does not pose a risk to groundwater. One additional well recently sampled with total mercury concentrations above the Class GA standard is MW-101 (1.5 µg/L) is located near the center of the parking lot directly within the calcium sulfate waste material. Monitoring well MW-37AQ is located along the edge of the parking lot area and reported a result of 0.933 µg/L just above the Class GA standard during a sampling event in 2003 conducted with historical sampling procedures.

Historical and Current Groundwater Results

The mercury concentrations measured in the Site's groundwater from all wells since 2000 are presented in Table 2.¹ In addition to the summary of results from wells sampled in 2025 included in Table 1, the remaining seven wells located at the site only had one detection of mercury (0.933 µg/L) just above the Class GA standard in 2003. Given the long timeline since former plant operations, in addition to the improvements in sampling methodology over the past two decades, it is noteworthy that the lowest concentrations in these wells are generally from the most recent sampling event from each monitoring well. Collectively, this data set indicates the overwhelming majority of the wells sampled at the Site are below applicable regulatory criteria.

¹ There are groundwater mercury data ca. 1991 that are available from the Remedial Investigation. However, these samples were taken before the standard practice of low-flow groundwater sampling and therefore may be biased.

Table 2
Summary of Historical and Current Mercury Concentrations in Groundwater

Well ID	Date	Total Mercury ^b (µg/L)	Dissolved Mercury ^b (µg/L)
MW-1S	3/25/2025	0.091 U	
	12/7/2023	0.091 U	
MW-2S	11/17/2025	0.091 U (0.091 U)	
MW-5S	11/21/2025	0.091 U	
MW-7S	11/20/2025	0.091 U	0.091 U
MW-9S	11/21/2025	0.28	0.16 J
MW-12S	11/18/2025	0.091 U	
MW-21S	11/18/2025	0.091 U	
MW-26S	11/19/2025	0.091 U	
MW-27S	11/21/2025	0.091 U	
MW-24S	3/25/2025	0.091 U	
	11/3/2023	0.13 J	
	6/15/2022	0.3	
	3/29/2021	0.26	
	12/11/2019	0.2	
	9/7/2018	0.2	
	7/19/2017	0.17	
	3/8/2016	0.76	
	11/11/2014	0.73	
	7/23/2013	0.55	
	4/25/2012	0.31	
	10/24/2011	0.4	
	4/26/2011	0.27	
	10/25/2010	0.4	
	4/19/2010	0.33	
	4/16/2008	1.1	
	10/16/2007	0.392	
	6/8/2006	0.3	
	7/15/2005	0.24	0.31
	7/1/2002	0.551	
	12/1/2001	0.765	
	4/1/2001	0.416	
	9/1/2000	0.416	
MW-28S	11/19/2025	0.11 J	
	6/8/2006	0.16	

Well ID	Date	Total Mercury ^b (µg/L)	Dissolved Mercury ^b (µg/L)
MW-28S	July 2005	0.21	0.2 B
	7/1/2002	0.27	
	12/1/2001	0.186	
	4/1/2001	0.215	
	9/1/2000	0.344	
MW-29S	11/19/2025	0.091 U	
	6/16/2006	0.07 U	0.07 U
	July 2005	ND	ND
MW-32 ^a	7/1/2002	0.59	
MW-35AQ	12/11/2003	0.167	0.0328
MW-35S	12/11/2003	0.0477	0.0157
MW-36AQ	12/11/2003	0.456	0.0821
MW-36S	12/11/2003	0.0196	0.0222
MW-37AQ	12/11/2003	0.933	0.00905
MW-37S	12/11/2003	0.00845	0.00262
MW-101	3/25/2025	1.5	
	12/7/2023	2.1	
MW-102	3/25/2025	0.091 U (0.091 U)	
	11/15/2023	0.091 U	
MW-106	11/19/2025	0.091 U	
MW-201	11/18/2025	0.15 J	
MW-202S	11/20/2025	14	0.35
AMW-1	11/20/2025	0.11 J	0.091 U
AMW-2	11/20/2025	0.21	
PZ-1	11/18/2025	0.091 U	
PZ-4	11/19/2025	0.091 U	
OW-6	11/17/2025	0.27 U	

Notes:

Bold items indicate most recent sample collected at that well location.

Green shading denotes values above the NYSDEC Class GA groundwater standard of 0.7 µg/L.

Laboratory qualifier and detection limit information not available for some data sources.

a. MW-32 is no longer in service but was located in the Parking Lot Area.

b. Field duplicates are presented in parentheses.

µg/L: microgram per liter

J: estimated, below the reporting limit

RI: remedial investigation

U: Below the method detection limit, value is method detection limit

B: Analyte detected in sample and field blank.

C) Partitioning Coefficient Considerations

Even when considering the highest concentration detected in the sample set, 14 µg/L found in 2025 at MW-202S, these results are still far below the concentrations to be expected if the mercury at the Site were in a mobile form. According to the NYSDEC derivation of the protection of groundwater SCO, the assumed partition coefficient (K_d) for mercury is 52 liters per kilogram (L/kg) using a dilution attenuation factor (DAF) of 20 (NYSDEC 2006a, 2023). Using this method of derivation, the potential groundwater concentrations originating from the total mercury concentrations in waste measured in 2024 were calculated in Table 3. The groundwater mercury concentrations found in Area 1 are lower than these values by 1.0 to 1.5 orders of magnitude, indicating that the mercury in the calcium sulfate waste is far less soluble and mobile than assumed in the SCO derivation.

Table 3
Hypothetical Aqueous Total Mercury Concentrations Using Calcium Sulfate Waste Samples and the NYSDEC Soil/Water Distribution Coefficient

Sample ID	Solid Mercury (mg/kg)	K_d (L/kg)	DAF	Hypothetical Aqueous Mercury (µg/L)
PL-C-1	290	52	20	279
PL-C-2	425	52	20	409
PL-C-3	500	52	20	481
PL-C-4	440	52	20	423
PL-C-5	520	52	20	500

Notes:

The K_d equation used for NYSDEC SCO derivation incorporates a DAF using the equation $C_s = K_d \cdot C_w \cdot \text{DAF}$ from NYSDEC 2006b.

D) TCLP Results

The toxicity characteristic leaching procedure (TCLP) data collected in 2024 also supports the conclusion of reduced solubility and mobility (See Attachment 1 for a description of the TCLP data). Table 4 shows K_d values calculated using paired solid (total mercury) and liquid (TCLP) concentrations found in the calcium sulfate waste samples. These calculated K_d values range from 32,500 to 357,143 L/kg. This shows that, at minimum, the Site mercury is 600-fold more sorptive than what is assumed with the K_d of 52 L/kg used in the derivation of the protection of groundwater SCO. The calculated K_d values in Table 4 are consistent with the K_d values for HgII (mercury salts; range of 24,000 to 270,000 L/kg and default value of 58,000 L/kg) used in the U.S. Environmental Protection Agency (USEPA) Mercury Study Report to Congress (USEPA 1997) based on the work of Lyon et al. (1997).

Table 4. Calculated Soil/Water Distribution Coefficients Using Total Mercury and TCLP Mercury Concentrations from Calcium Sulfate Waste

Sample ID	Solid Mercury (mg/kg)	TCLP Mercury (µg/L)	Calculated K_d (L/kg)
PL-C-1	290	6.7	43,284
PL-C-2	425	1.7	250,000
PL-C-3	500	1.4	357,143
PL-C-4	440	3.8	115,789
PL-C-5	520	16	32,500

Note:

The equation $C_s = K_d \cdot C_w$ was used to calculate K_d

The comparison of Site data to the K_d derivations done by NYSDEC and USEPA emphasizes that the mercury present on the Site is comfortably within the parameters of what is considered mercury salts by both agencies. Additionally, there are indications that the somewhat higher groundwater concentrations found in Area 1 may be a result of particulate-bound mercury in the groundwater. First, all wells with total mercury concentrations above the NYSDEC Class GA standard are proximal to calcium sulfate waste material. Second, the dissolved mercury concentration of 0.35 µg/L measured at MW-202S was not only much lower than the total mercury concentration of 14 µg/L but also below the Class GA standard.

Surface Water Data

Surface water quality testing performed during the 1995 RI and by NYSDEC in 1995 showed the concentrations of mercury were generally consistent between upstream and downstream sampling locations. In 2014, surface water samples were collected from seven locations along the West Branch of the Ramapo River, starting with an upgradient location near the northwest corner of the Site and ending with a location approximately 1,000 feet downstream. All samples collected in 2014 were below the detection limit of 0.2 µg/L.

4) Fish Study

In 2001, prior to the installation of the riverbank Interim Remedial Measure (IRM) along the Parking Lot Area, NYSDEC conducted a study in the Ramapo River to evaluate mercury levels in fish tissue. The study concluded that fish in the West Branch of the Ramapo River do not contain mercury above the numerical guideline that would have required any fish consumption advisories at that time (1,000 nanograms per gram [ng/g], NYSDEC 2001). Since that study, the guideline has been reduced; the least stringent advisory is 220 ng/g (i.e., for four meals per month) (NYSDEC 2024). But application of this new guideline does not change the conclusions because all the concentrations directly upstream and downstream of the Site continue to be under the guideline.² To further contextualize the fish

² One average fish mercury concentration located far downstream in Sloatsburg was 412 ng/g.

concentrations identified in 2001, additional analysis of the NYSDEC fish study data was performed by Cornerstone and submitted to NYSDEC in 2015 (Cornerstone 2015). This additional analysis showed there were no distinguishable differences between fish concentrations upstream and downstream of the Site.

5) Mercury Speciation

The fate and transport and potential bioavailability characteristics of mercury in Site soil were evaluated in the 2007 RFI through a series of separation and analytical procedures known as selective sequential extraction (SSE; Bloom et al. 2003) and methyl mercury analysis. The results indicate low likelihood of elemental mercury presence, little to no methyl mercury presence, and overall low environmental mobility and bioavailability of mercury and was approved by NYSDEC in 2023 (Cornerstone and Brown and Caldwell 2023). Although the soil and calcium sulfate material in the Parking Lot Area are different matrices with different sources of mercury, the speciation results and documented low mobility further support that the mercury, as a whole, is inorganic and not in a soluble form. As noted in the 2023 NYS Brownfield Technical Support Document, if mercury is found in soil above the published SCO, then subsequent analysis of the separate species of mercury can be taken into consideration during the remedy selection process (NYSDEC, 2023).

Conclusion

These multiple lines of evidence support that mercury on the Site is not elemental mercury. Rather, mercury is present in a low-solubility form, likely mercury sulfides or other insoluble salts; and is not leaching into groundwater from the calcium sulfate material in the Parking Lot Area or Site soil in the Lagoon, or floodplain and main plant area. This is consistent with the knowledge of former operations at the Site and confirms the statement noted in the ROD on Page 5 that the mercury present in this area exists in a highly immobile form (NYSDEC 1997). Consequently, the data supports the use of an SCO for inorganic mercury salts. The mercury salts SCO would still be conservative because it is based on mercuric chloride, which has a much higher degree of mobility than that observed at the Site. This proposed SCO is also consistent with the current commercial zoning and reasonably anticipated future use of the Site.

References

- Anchor QEA and Brown and Caldwell (Anchor QEA and Brown and Caldwell Associates), 2024. *Phase III Emerging Contaminants Site Investigation Report, Former Nepera Plant Site, Harriman, New York, EPA ID No. NYD002014595*. Former Nepera Harriman Site Remediation. Prepared for ELT Harriman, LLC, Nepera, Inc., and Warner-Lambert Company, LLC. June 28, 2024.
- Anchor QEA and Brown and Caldwell, 2025. *Interim Site Management Plan, Former Nepera Plant Site, Harriman, New York, EPA ID No. NYD002014595*. Former Nepera Harriman Site Remediation. Prepared for ELT Harriman, LLC, Nepera, Inc., and Warner-Lambert Company, LLC. February 28, 2025.
- Arcadis (Arcadis G&M, Inc.), 2005. Letter to: New York State Department of Environmental Conservation, Division of Environmental Remediation. Regarding: Revised River Bank Capping Work Plan. Harriman Inactive Waste Disposal Site: Site No. 336006. May 31, 2005.
- Brown and Caldwell (Brown and Caldwell Associates), April 2007a. *RCRA Facility Investigation Report*. Former Nepera Plant Site, Harriman, New York, EPA ID# NYD002014595. Prepared for: Rutherford Chemicals, LLC. April 24, 2007.
- Brown and Caldwell, 2008. Memorandum to: Paul Patel, New York State Department of Environmental Conservation (NYSDEC). Regarding: Supplemental RFI. Former Nepera Site, Harriman, New York. August 5, 2008.
- Brown and Caldwell and Cornerstone Engineering and Land Surveying, March 2011. *Site-wide Characterization Summary Report, Former Nepera Facility, Harriman, New York*. Prepared for ELT Harriman and Maybrook and Harriman Environmental Trust. March 2011.
- Brown and Caldwell, May 2015. *Supplemental Remedial Investigation Report*. Former Nepera Plant Site. Harriman, New York. May 2015.
- Brown and Caldwell, November 2007. *CMS Plan and Task I Report*. Former Nepera Plant Site; Harriman, New York. November 2007.
- Brown and Caldwell, November 2007. *Phase II RCRA Facility Investigation Work Plan*. Former Nepera Plant Site, Harriman, New York. November 2007.
- Conestoga-Rovers (Conestoga-Rovers & Associates), 1995. *Remedial Investigation: Harriman Site*. Volume 1 of 2 – Text, Figures, Tables. Village of Harriman, Orange County, New York. Ref. No. 3697 (14). July 1995.

- Cornerstone (Cornerstone Engineering & Land Surveying, PLLC), 2014. *Supplemental Remedial Investigation Report*. Former Nepera Harriman Site, Harriman, New York. Prepared for Nepera, Inc. and Warner-Lambert Company, Corporate Defendants. November 2014.
- Cornerstone (Cornerstone Environmental Group, LLC), 2010. Letter to: Michael Mason, PE, New York Department of Environmental Conservation, Division of Environmental Remediation, Bureau of Construction Services. Regarding: Harriman Inactive Waste Disposal Site #336006, Area B Parking Lot Investigation. April 16, 2010.
- Cornerstone and Brown and Caldwell (Cornerstone Engineering and Geology, PLLC, and Brown and Caldwell Associates), 2023. *Supplemental Floodplain Soil Investigation Report*. Former Nepera Harriman Site, Harriman, New York, Site No. 3-36-006. Prepared for Nepera, Inc., Warner-Lambert Company, LLC, and ELT Harriman, LLC. September 2023.
- Cornerstone, 2015a. Letter to: Paul Patel, PE, New York Department of Environmental Conservation, Division of Solid and Hazardous Materials. Regarding: Harriman Inactive Waste Disposal Site #336006, Supplemental Remedial Investigation, NYSDEC Fish Study Data. September 28, 2015.
- Cornerstone, 2015b. *Addendum No. 1 to the Supplemental Remedial Investigation Report*. Former Nepera Harriman Site, Harriman, New York. Prepared for Nepera, Inc. and Warner-Lambert Company, Corporate Defendants. September 2015.
- Cornerstone, 2016. *Revised, Parking Lot Area Feasibility Study*. Former Nepera Harriman Site, Site No. 336006. Prepared for Nepera, Inc. and Warner-Lambert Company, Corporate Defendants. August 2016.
- Gorin, A.H., J.H. Leckey, L.E., and L.E. Nulf, 1994. *Final Disposal Options for Mercury/Uranium Mixed Wastes from the Oak Ridge Reservation*. Oak Ridge Y-12 Plant, August 29, 1994
- Hagelberg, Erik, [date unknown]. *The Matrix Dependent Solubility and Speciation of Mercury*. Orebro University. [date unknown].
- Kalb, P.D. and L. Milian, 2008. *In Situ Mercury Stabilization (ISMS) Treatment Technology, Technology Maturation Project Phase I Results*. Internal BNL Report to Office of Intellectual Property and Sponsored Research; 2008.
- Lisicki, D., K. Nowak, and B. Orlinska, 2022. "Methods to Produce Nicotinic Acid with Potential Industrial Applications." *Materials* 15(3): 765.

- Lopez, F.A., F.J. Alguacil, C.P. Roman, H. Tayibi, and A. Lopez-Delgado, 2008. "Disposal of Elemental Mercury via Sulphur Reaction by Milling," First International Conference on Hazardous Waste Management, 2008
- Lyon, B.F., G.A. Rice, R.A. Ambrose, and C.J. Maxwell, 1997. "Calculation of Soil-Water and Benthic Sediment Partition Coefficients for Mercury." *Chemosphere* 35(4): 791-808.
- Mattus, C., H., 2001. *Measurements of Mercury Released from Solidified/Stabilized Waste Forms*. Oak Ridge National Laboratory, April 2001.
- Morris, Michael I., I.W. Osborne-Lee, and G.A. Hulet, 2002. *Demonstration of New Technologies Required for the Treatment of Mixed Waste Contaminated with >260 ppm Mercury*. ORNL/TM-2001/147, U.S. Department of Energy, Office of Science and Technology, January 2002.
- NYSDEC (New York State Department of Environmental Conservation), 1997. *Record of Decision*. Nepera, Inc. – Harriman Inactive Hazardous Waste Site, Harriman, Orange County, Site No. 336006. March 1997.
- NYSDEC, 2001. *Fact Sheet: Ramapo River Fish Sampling*. June/July 2001.
- NYSDEC, 2006a. *New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives*. Technical Support Document. September 2006.
- NYSDEC, 2006b. 6 NYCRR Part 375, Remedial Program Soil Cleanup Objectives, Effective December 2006.
- NYSDEC, 2010. *DER-10, Technical Guidance for Site Investigation and Remediation*. May 3, 2010.
- NYSDEC, 2010a. *CP-51 Soil Cleanup Guidance*. DEC Policy. October 21, 2010.
- NYSDEC, 2011. *DER-31/Green Remediation*. DEC Program Policy. January 20, 2011.
- NYSDEC, 2023. *New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives*. Technical Support Document 2020 Addendum. March 2023.
- NYSDEC, 2024. Background Information. Table 2. New York State Fish Consumption Numerical Mercury Guidelines. Last Updated March 2024. Available at:
https://www.health.ny.gov/environmental/outdoors/fish/health_advisories/background.htm
- SAIC, 1998. *Technologies for Immobilizing High Mercury Subcategory Wastes*. July 17, 1998.
- Science Applications International Corporation [SAIC], 2005. *Economic and Environmental Analysis of Technologies to Treat Mercury and Dispose in a Waste Containment Facility*. April 2005.

Shive, W. and R.A. Glenn, 1946. *Synthesis of Nicotinic Compounds*. (U.S. Patent No. 2,409,806). United States Patent Office. Available at: <https://patents.google.com/patent/US2409806A/>.

Svensson, M., B. Allard, and A. Duker, 2006 "Formation of HgS – Mixing HgO or Elemental Hg with S, FeS or FeS₂." *Science of the Total Environment*, 368:418–423.

U.S. District Court, 2013. *State of New York v. Estate of William S. Lasdon, Nepera, Inc., and Warner-Lambert Company*. 98 Civ. 3165 (KTD). United States District Court, Southern District of New York. December 17, 2013. Available at: https://extapps.dec.ny.gov/data/DecDocs/336006/Consent%20Order.HW.336006.2014-01-30.Defendants_Nepera_Inc._and_Warner-Lambert_Company.pdf.

URS Australia Pty Ltd, 2008. *Final Report, Human Health and Environmental Risk Assessment, Former ChlorAlkalai Plant, Botany Industrial Park*. August 2008.

USDOE (U.S. Department of Energy), 1999. Mercury Contamination—Amalgamate (contract with NFS and ADA): Stabilize Elemental Mercury Wastes, DOE/EM-0472 (OST #1675 2), Innovative Technology Summary Report.

USEPA (U.S. Environmental Protection Agency), 1975. Materials Balance and Technology Assessment of Mercury and Its Compounds on National and Regional Bases. Office of Toxic Substances, Washington, DC.

USEPA (U.S. Environmental Protection Agency), 1997. *Mercury Study Report to Congress: Volume III Fate and Transport of Mercury in the Environment*. EPA-452/R-97-005. Office of Air Quality Planning and Standards and Office of Research and Development, Washington, DC. Available at: <https://clu-in.org/download/contaminantfocus/sediments/report-to-Congress-volume3.pdf>.

Woodward, C.F., C.O. Badgett, and J.C. Kaufman, 1944. "Chemical-Catalytic Liquid-Phase Oxidation of Nicotine, Beta-picoline, and Quinoline to Nicotinic Acid." *Industrial and Engineering Chemistry* 38(6): 544–546.

Figures

- Figure 1 Niacinamide Manufacturing Process Diagram
- Figure 2 Notes on Niacinamide Production
- Figure 3 Niacinamide Synthesis Pathway
- Figure 4 Combined Aquitard and Overburden Aquifer Groundwater Elevation Contours (June 2024)

Attachments

Attachment 1 Parking Lot (Area 1) Data Gap Study Report

Attachment 2 Supplemental Groundwater Mercury Sampling - Data Summary Report

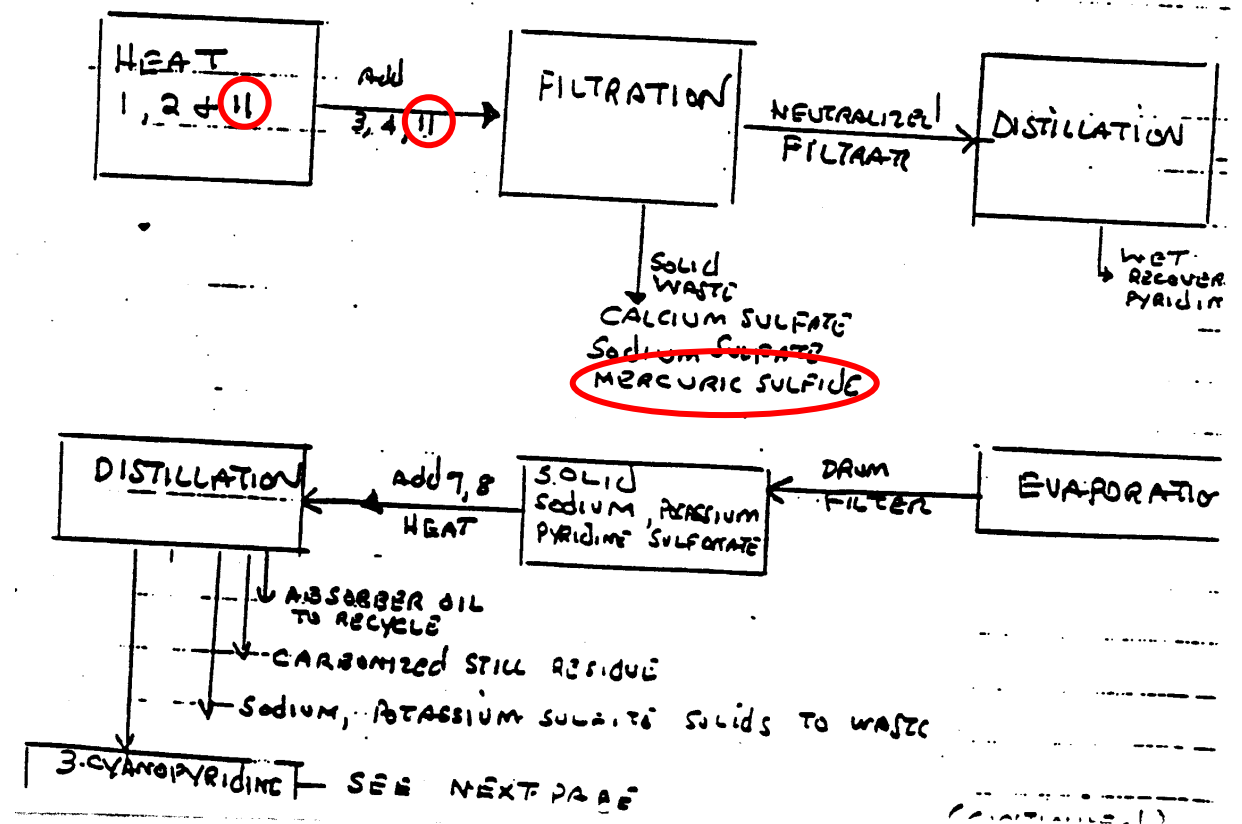
Figures

Niacinamide, USP 1940-1950's Process

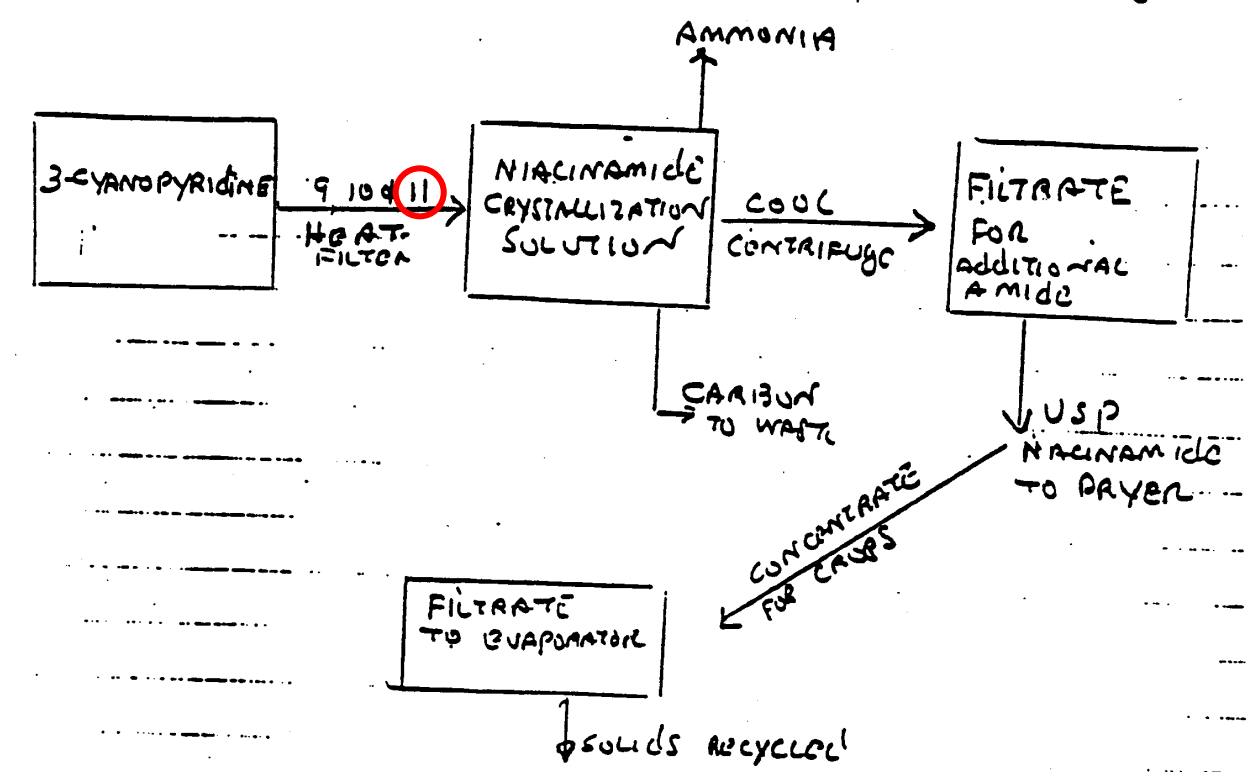


RAW MATERIALS

1. Pyridine
2. Oleum (22%)
3. Sodium Sulfide
4. Calcium Carbonate
5. Sodium Carbonate
6. Potassium Carbonate
7. Sodium Cyanide
8. Absorber Oil
9. Sodium Hydroxide
10. WATER
11. MERCURY
12. DARCO



50 PAGE 2



WASTE

1. Solid waste, calcium, sodium sulfate, MERCURIC SULFIDE
2. CARBONIZED STILL RESIDUE
3. Sodium and POTASSIUM SULFATE SOLIDS
4. CARBON CAKE
5. AMMONIA TO ATMOSPHERE

Notes: Process Diagram was presenting in the 1997 Record of Decision
All reference to mercury in the production diagram is circled in red



Figure 1
Niacinamide Manufacturing Process Diagram

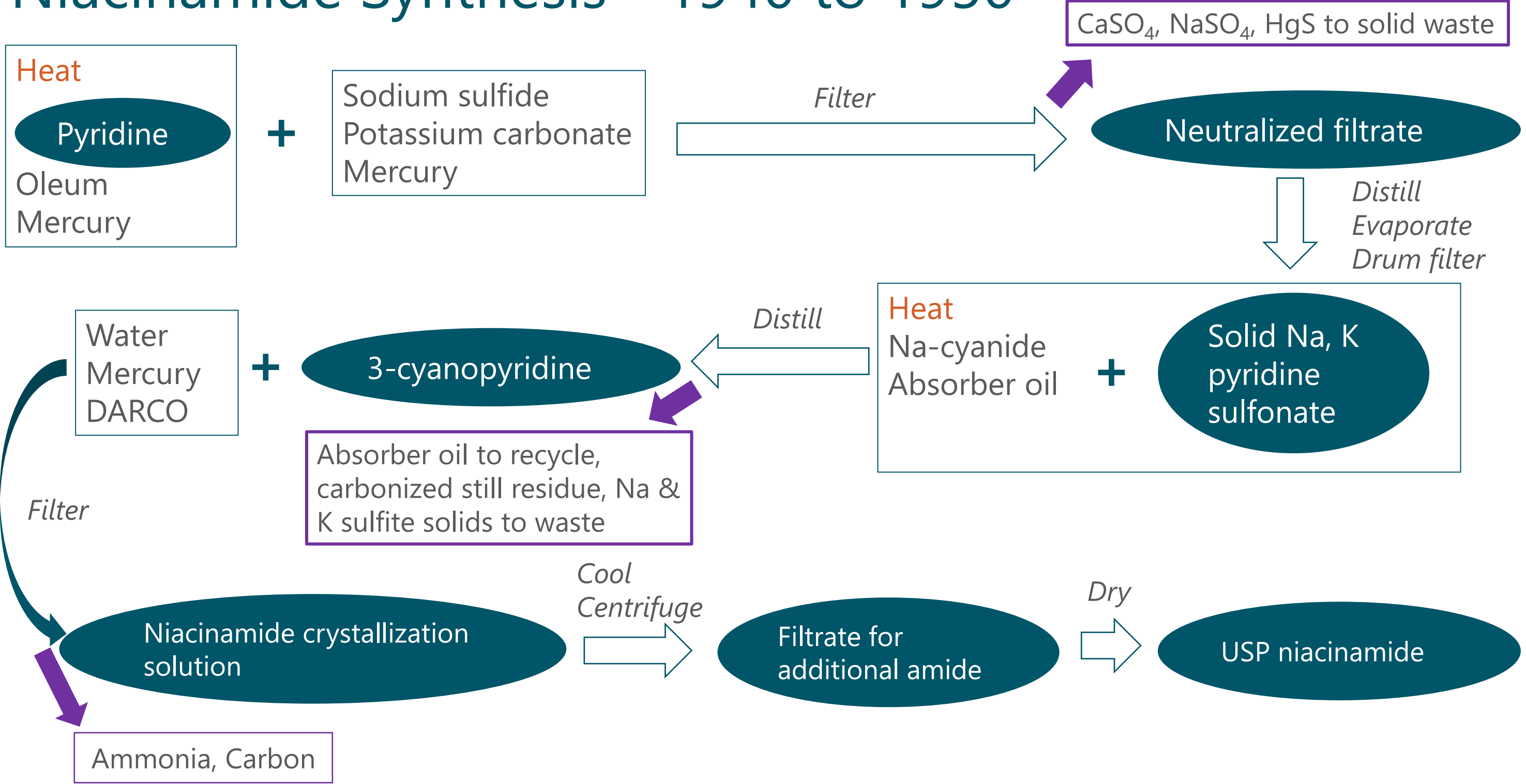
HgSO₄ as a Catalyst in the Production of Niacinamide

- Current and historical papers describe the initial step (i.e., production of pyridine sulfonic acid or sulfonate, the precursor to niacinamide) as the reaction of pyridine with oleum (fuming sulfuric acid) and mercuric sulfate (HgSO₄) as a catalyst
- This is consistent with the hand-drawn process diagram in the ROD (Figure 1), assuming “Mercury” is HgSO₄

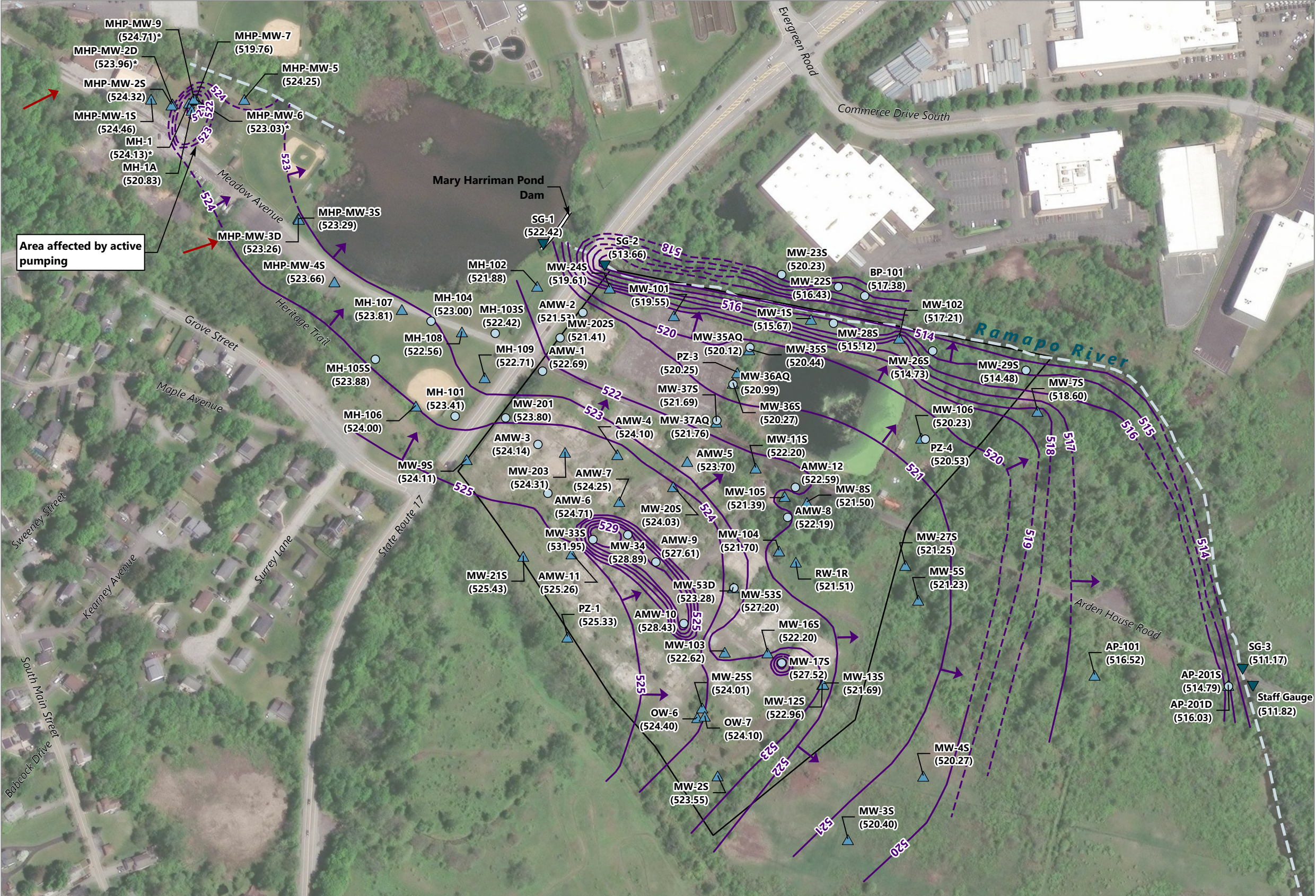


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Niacinamide Synthesis ~1940 to 1950



Filepath: https://anchorqea.sharepoint.com/p:/r/sites/NeperaWLC/Shared%20Documents/Nepera%20Harriman/Documents/Plant_Area/FS_CMS/Mercury_SCO_Tech_Memo/Figure_1%20Niacinamide%20Production%20Diagram.pptx?d=wd7c911ae698448b888778058dd9d9fef&csf=1&web=1&e=5zBaF0



LEGEND:

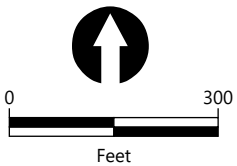
- ▼ Staff Gauge
- Aquitard Monitoring Well Location
- ▲ Overburden Aquifer Monitoring Well Location
- Streams
- Site Boundary
- ▬ Dam

Groundwater Contours (Feet NAVD88)

- Elevation Contour
- - - Inferred Contour
- ➔ Groundwater Flow Direction per June 2024 Monitoring Event
- ➔ Inferred Shallow Groundwater Flow Direction (source: 1995 Gaess Data as shown on Figure 1 of Gaess/Harriman Work Plan; Barton & Loguidice, November 2021)

NOTES:

1. Aerial imagery from Esri Online Services collected May 2025.
2. Streams from National Hydrography Dataset (NHD).
3. Groundwater elevations based on depth to water measurements recorded June 17 and 18, 2024.
4. (516.03): indicates measured groundwater elevation in feet North American Vertical Datum, 1988 (NAVD88).
5. MHP-MW-6, MHP-MW-7, and MHP-MW-9 are presumed to be screened within the overburden aquifer.
6. *: asterisk indicates data not used for contouring due to well depth or inconsistencies potentially resulting from active pumping in this area.



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Filepath: \\GSTFile01\\GIS\\Jobs\\Nepera_3099\\Maps\\GroundwaterMonitoring\\2025\\MercurySampling\\GroundwaterMercurySamplingReport.aprx | AQ_Nepera_MercurySR_Fig03_GroundwaterElevationContours



Figure 4
Combined Aquitard and Overburden Aquifer Groundwater Elevation Contours (June 2024)

Technical Memorandum on Mercury Speciation and Applicable Soil Cleanup Objectives
Nepera Plant Site, Harriman, New York

Attachment 1

Parking Lot (Area 1)

Data Gap Study Report

Attachment 2

Supplemental Groundwater Mercury
Sampling

Data Summary Report
