REPORT ON THE

MERCURY MANOMETER PROGRAM

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Healthy Kansans living in safe and sustainable environments.

Prepared by:

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Bureau of Environmental Remediation
Curtis State Office Building
1000 SW Jackson
Topeka, Kansas 66612

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REPORT ON THE MERCURY MANOMETER PROGRAM

BACKGROUND

From its inception, the natural gas industry has used mercury manometers extensively to monitor gas pressure and flow at wellheads, gathering systems, facilities, and transmission/distribution lines. A typical manometer contains 8 to 10 pounds of elemental mercury. The meter stations are located throughout the United States and are typically housed in small (frequently 4' x 6' x 6') sheet-metal sheds called "meter houses," often having dirt floors. Elemental mercury was inadvertently released at a number of meter houses as a result of servicing the meter, pressure surges, leakage, equipment malfunction, vandalism, or operator error. Multiple releases likely occurred at most meter houses. Most of the mercury was released to the floor, but elemental mercury has also been found on shelves, sills, and pipeline appurtenances within the shed. Mercury released to the floor of a shed could be transported by the shoes of maintenance workers to areas outside the meter house.

In 1990 and 1991, under the authority of KDHE's Bureau of Waste Management (BWM), one of the larger natural gas companies remediated several of these meter stations. By 1992 natural gas industry publications (e.g., publications by the Gas Research Institute (GRI)) informed the industry about the potential threats to human health and the environment posed by the meter stations. By 1992 environmental technical managers were also aware of the proposed effective date for Land Disposal Restrictions (LDRs or "Land Ban") regulations. In 1992 the same company working with KDHE's BWM approached the KDHE's Bureau of Environmental Remediation (BER) and proposed to address hundreds of manometer stations under its jurisdiction through a KDHE cleanup program. The company hoped to realize a savings by addressing the sites before the LDRs became effective.

Research into potential threats to human health indicated the most immediate health concern was the exposure of workers to mercury vapors. Most meter stations in Kansas are located in remote areas away from residences. Yet, as stated in the GRI Technical Report of August 1993, an elemental mercury spill inside a poorly ventilated meter house could theoretically release mercury vapors that exceed the OSHA acceptable limit in air of 0.1 mg/cubic meter. Kansas has been a leading natural gas producing state since the early Twentieth Century. Given the long, unregulated history of natural gas production in Kansas, KDHE/BER recognized that there were potentially thousands of mercury contaminated stations. Over a number of years, workers servicing meters could visit a large number of contaminated meter stations. Given the potential magnitude of the problem, KDHE/BER initiated the Mercury Manometer Program in cooperation with many of the pipeline companies operating with the State of Kansas.

PHASE I - ASSESSMENT AND PHASE II - CHARACTERIZATION

To establish the Program, the following essential components had to be developed: 1) a means of identifying sites, 2) soil cleanup standards for mercury contamination, and 3) Scopes of Work (SOWs) for characterizing and remediating the sites. The most important task was to develop cleanup standards protective of human health. KDHE-BER contracted with a private consulting

company to derive human health, risk-based cleanup standards for mercury in soils. The standards proposed were 2.0 mg/kg for residential land use and 20.0 mg/kg for non-residential land use. Land use was determined to be "residential" if a meter station was within 200 feet of a residence. The cleanup standards became final on March 16, 1993. Based on the soil cleanup standards for mercury, separate draft SOWs for Characterization (Phase II) and Remediation (Phase III) were developed in the spring of 1993. Copies are included in Attachments 1 and 2. Both SOWs underwent revisions; the Characterization SOW became final in July 1993; the Remediation SOW became final in October 1994. Most meter stations were similar in construction; hence, the requirements and procedures outlined in the SOWs were straightforward and specific. The sampling procedures were at the same time adaptable to different conditions. From the two SOWs, natural gas pipeline companies could readily draft work plans.

The Program developed the Site Assessment (Phase I) component as a means of identifying sites (Attachment 3). The initial step of this component was to establish a database of natural gas companies operating in Kansas; information for the database was obtained from the Kansas Corporation Commission (KCC). A Fact Sheet (Attachment 4) was then developed to send to these companies and other interested parties; it became final on June 17, 1993. By this time the USEPA had been informed of the mercury characterization and remediation program and supported it; a copy of the letter from EPA to Northern Natural Gas is in Attachment 5.

In the spring and summer of 1993, KDHE sent a written notification letter to each company in the pipeline database. A Fact Sheet, a Characterization SOW (Attachment 1), and an Interim Agreement were attached to the letter. After briefly explaining the potential threats to human health at mercury manometer stations, the letters asked each company: 1) to conduct a historical search of all mercury manometer stations under its jurisdiction and determine if mercury manometers had been used and/or were currently being used in its operations; and 2) to provide a list (with legal descriptions) of all stations where mercury had been used. The search into historical use was the essential step in the Phase I Assessment of the Mercury Program, requirements for which were outlined in the Characterization (Phase II) SOW. With the promulgation of RCRA regulations governing mercury, larger companies with RCRA-permitted facilities had already replaced mercury meters with a bellows "dry-flow" meter by 1993. (Today the bellows "dry-flow" meter is being replaced with electronic meters that provide continuous digital readouts. KDHE has noted that some of the smaller pipeline companies continue to use mercury meters.)

If the company's historical research found mercury had been used and if the company wanted to participate in the Mercury Program, the notification letter asked the company to sign an Interim Agreement. The Program typically used a voluntary Interim Agreement as the legal mechanism for participating in characterization activities, since KDHE's Voluntary Cleanup and Property Redevelopment Program (VCPRP) would not be established by statute until July 1, 1997. The Program used a Consent Order as the legal mechanism for some companies electing to conduct characterization and remediation activities under one legal mechanism. The signing of the Interim Agreement marked the end of Phase I and the beginning of Phase II Characterization.

The Characterization SOW developed by the Program outlined an investigative approach for producing data that would satisfy KDHE requirements and from which an approvable work plan could be developed. The approach for investigating the identified stations included procedures to

determine whether mercury was present and to approximate the nature and extent of any mercury contamination found. Two sampling scenarios were developed to characterize an existing meter station; selecting the appropriate scenario depended on whether the floor material of the meter shed was soil/gravel or concrete/steel (Attachment 6). At stations with a soil or gravel floor, samples were collected inside the shed beneath and near the meter. At stations with a steel or concrete floor, soil samples were collected outside the shed near the entry. A third sampling scenario was developed for meter stations that had been removed from service. A field screening technique using a Mercury Vapor Analyzer (MVA) was also developed to protect investigative workers and help focus soil sampling. Following MVA screening, two discrete soil samples and one composite sample were collected for each scenario and sent to a lab for total mercury analysis. If mercury was visible in the soil, the station was proposed for remediation without conducting further soil sampling.

The Characterization SOW required the submittal of a Characterization Report to present findings. Under the Interim Agreement, companies with a large number of sites were allowed to spread characterization activities and reporting requirements over as many as four years. If mercury was visible or if mercury was present in concentrations exceeding the cleanup standards, the station was proposed for remediation. Once the Characterization Report was approved, negotiations for a Consent Order began. The Program used the Consent Order as the legal authority for participating in remedial activities. If all characterization activities had been satisfactorily completed, the Interim Agreement was terminated once the Consent Order had been signed.

PHASE III - REMEDIATION

A Remediation (Phase III) SOW was attached as an exhibit to the Consent Order. The Remediation SOW outlined the procedures and requirements for remediating stations with mercury soil contamination to cleanup levels deemed protective of human health. A remediation work plan could be developed readily from the Remediation SOW. Appropriate remedial techniques and verification sampling procedures were developed, as well as procedures to satisfy RCRA hazardous waste requirements governing: 1) the remedial technologies to be implemented and 2) the handling, treatment, storage, and disposal of free elemental mercury and potentially hazardous mercury-contaminated soils removed from the stations. Because the cleanup standards were risk-based to protect human health, additional options and flexibility were realized in meeting RCRA requirements.

Possible remedial technologies were developed from four waste classifications that were determined primarily by RCRA classifications for hazardous waste and RCRA LDRs. Because the cleanup standards were risk-based, mobile treatment units (MTUs) were allowed under a recycling provision in RCRA.

1. Non-Hazardous Waste: excavated soils could be disposed in a Subtitle D landfill or treated with a mobile treatment unit (MTU); on-site or central staging areas were allowed. A list of county Subtitle D landfills was attached to the Remediation SOW. To dispose of non-hazardous soils, approval from the Subtitle D landfill and a Special Waste Authorization from KDHE's BWM had to be obtained. Treated soils could be returned to the place of origin if mercury concentrations were below cleanup levels.

2. Hazardous Waste with Low Total Mercury (< 260 mg/kg): excavated soils could be transported to an approved treatment, storage, or disposal facility (TSDF). An EPA temporary ID number was required, but no hazardous waste authorization. MTUs could only be used on-site; treated soils could be returned to the site, provided mercury concentrations were below clean-up levels.

3. Hazardous Waste with High Total Mercury (>260 mg/kg): excavated soils had to undergo treatment using best developed available technology (BDAT)–roasting and/or retorting for mercury. MTUs could be used only on-site; treated soils had to be transported to a TSDF.

4. Free/Elemental Mercury: recovered free mercury was classified as D009 waste and could either be transported to a TSDF or be recycled. If the work plan stated the intent to recycle the mercury, and a recycling facility furnished containers and took possession, no temporary EPA ID number needed to be obtained.

KDHE's BWM allowed staging of excavated soils before transporting them to a TSDF or treating them with a MTU on a case by case basis. Staging areas at nearby compressor stations were allowed because the compressor stations already had an EPA ID number. Soils excavated from meter stations were placed in plastic bags, labeled with an identifier specific to the station, transported to the staging areas, and segregated according to station. Composite samples were then collected from the bags from each station and analyzed by the toxicity characteristic leaching procedure (TCLP) to determine whether the soils were hazardous and which remedial technique to implement.

As specified in the Remediation SOW, the minimum depth and minimum area of the initial excavation depended on the characterization results and the meter shed floor material. Additional sampling at each station consisted of: 1) sampling to verify unexcavated station soils met cleanup standards and 2) sampling to verify fill, whether from MTU output being returned to the site or other sources, met cleanup standards. Verification samples at the station consisted of three composite samples–one four-point composite sample from the base of the excavation and two two-point composite samples from adjacent or opposite excavation sidewalls. A plastic liner followed by clean fill material was placed over the initial excavation. If verification samples exceeded cleanup levels, excavation continued. Any visible free mercury on hard surfaces within a shed was collected for recycling by sweeping or vacuuming. Following remedial activities, the SOW required a final report to present remediation and waste handling results. Following approval of the final report, the Consent Order was terminated, provided all other issues had been resolved.

CURRENT PRACTICE

The VCPRP was established in 1997 following Legislative approval and the Governor's signature of the associated statutes. Many of the sites in the Mercury Program were completed and/or underway by the time the VCPRP was in operation. Those sites that were not participating in the Mercury Program by July 1, 2007, were referred to the VCPRP to address identified mercury

issues. There are currently 11 sites remaining in the VCPRP. ANR Pipeline has ten sites, of which six have been remediated, and KDHE is currently waiting for final reports on these sites. Southern Star Central Gas has one site which is scheduled for remediation in late 2010.

SUMMARY AND CONCLUSIONS

The reporting requirements for the characterization and remediation phases were presented in the respective SOWs and restated in the legal agreements for the two phases--the Interim Agreement and the Consent Order. In addition to a characterization work plan and report, a quality assurance plan (QAP) and a health and safety plan (HASP) were required. The QAP and HASP could be used for the remediation phase. For remediation, a work plan and a final report were required. The work plans for both phases had to satisfy the requirements specified in the SOWs.

KDHE field oversight was an essential component of the Program, serving as a QA/QC check on both field and laboratory procedures. The oversight consisted of collecting split soil samples from 10% or more of the sites and analyzing the samples for total mercury. Oversight findings underscored the need for thoroughly mixing composite samples and thoroughly mixing samples before analyzing them at the lab. For example, analytical results occasionally showed very low concentrations of mercury from samples in which KDHE had noted the presence of visible mercury. KDHE suspected small beads of mercury migrated to the bottom of the sample jar during transport. To correct this, KDHE requested special instructions be given to the analytical lab to thoroughly mix the samples before analyzing them and for the samples be stored upside-down during transport.

MVA screening readings less than 0.015 and 0.005 mg/cubic meter indicated soil samples sent to the lab for analysis would likely yield a mercury concentration below KDHE's cleanup standards for the respective non-residential and residential land uses.

Because of the low solubility of elemental mercury, only a few (approximately 1%, or 20 out of 2,000) sites had soil samples failing TCLP. Soils from these sites underwent BDAT before disposal. Sites with soils failing TCLP had high concentrations of mercury and were found in sandy soils. Once this fact was recognized, the urgency by some companies to remediate the sites before the LDRs became effective diminished.

Table 1 illustrates that 6,530 sites were characterized by 2010. This number represents the number of meter stations where mercury was used historically. The number of sites assessed as having no historical use of mercury is unknown; the industry estimated there were up to 10,000 potential sites in Kansas. Of the 6,530 sites where mercury had been used, 2,595 (or 40%) required remediation. Mercury concentrations were greater in soils at meter houses with soil/gravel floors where samples were collected within the shed than at meter houses with concrete floors where samples were collected outside of the shed. Free elemental mercury was more readily recovered for recycling from stations with concrete floors. The highest concentrations were beneath the meter, extending laterally 1.5 feet and vertically 1.0 foot. Elemental mercury occurs as small beads and is not readily sorbed by soils and organic matter. It was found that the beads of mercury were too large to migrate through soil pores, although mercury beads did migrate through soil cracks. Most soil

contamination occurred at depths less than 12 inches; the mercury contamination rarely migrated to depths greater than 24 inches.

Most investigative and remedial work at the stations was conducted using Level "D" protection, provided the Occupational, Safety, and Health Administration (OSHA) threshold level of 0.1 mg/cubic meter was not exceeded. If this level was exceeded, the work was conducted using Level "C" protection. Some contracting companies used Level "C" at all times even if screening levels were not exceeded. Most excavation work was done using hand-tools.

An estimate of the total volume of soils remediated in the Program can be calculated by multiplying the number of remediated sites by 1.5 cubic yards per site. As noted in Table 1, 1.5 cubic yards per/site represents an average of the 2.0 cubic yards of soil excavated from sites with earth or gravel floors and the 1.0 cubic yard of soil excavated from sites with concrete floors. Thus, 3,892 cubic yards were remediated since the inception of the program. Of that amount, approximately 200 cubic yards were treated, 100 cubic yards of treated soils were returned to the sites, and 3,559 cubic yards were disposed in Subtitle C or Subtitle D landfills.

Desiring to reduce potential future liability, many larger companies disposed of non-hazardous mercury-contaminated soils at a TSDF (Subtitle C landfill) in Oklahoma. To date, only two companies have elected to treat mercury contaminated soils. Both companies sent their mercury contaminated soils to a treatment unit in Indiana. No MTUs were operated in Kansas. Apparently bringing an MTU to Kansas was not as cost effective as disposing of the soils in a Subtitle C landfill. Only a few small companies continue to use mercury manometers.

Some companies have experienced difficulties tracking the data for an individual site through the program, mostly because ownership of the sites has been transferred. Also, some companies with a large number of sites have found it difficult to organize and manage the large amount of information generated.

As shown in Table 1, the ANR Pipeline and Southern Star Central Gas sites are listed as "in progress." Remediation has been completed at the ANR Pipeline sites, with the exception of submittal of final reports. KDHE expects ANR Pipeline to finish the VCPRP by December 2010. An investigation has been completed at the Southern Star Central Gas site; however, remediation has not been completed.

TABLE 1: MERCURY METER PROGRAM REPORT

September 2010

PARTY	DATE INITIATED	DATE FINISHED	# SITES CHARCT.	# SITES REMED.
1. AMOCO	05-20-96	03-19-98	793	488
2. ANADARKO	06-14-94	11-07-95	17	0
3. ANR PIPELINE	08-24-93	In Progress	17	8
4. BENSON MINERAL GRP	09-06-94	05-31-96	13	6
5. COLORADO INTER GAS	08-24-93	04-24-09	524	81
6. DORCHESTER HUG LTD	09-13-95	06-19-96	11	1
7. DUKE ENERGY FIELD	03-30-00	12-28-01	110	12
8 GETTY GAS GATHER	03-08-94	09-12-95	4	2
9.GREELEY GAS GATHER	08-21-02	11-06-03	40	27
10. KANSAS PUBLIC SERV.	05-27-93	01-07-94	1	0
11.KN ENERGY (Former) KINDER MORGAN (Current)	08-01-95	12-04-02	636	351
12. MAC COUNTY GAS	01-20-95	04-07-97	6	5
13. MESA (Former) OP CO PIONEER (Current)	05-05-95	12-27-99	189	54
14. MIDWEST ENERGY	10-18-93	12-06-94	28	19
15. MOBIL	04-17-98	12-21-01	203	12
16. NAT GAS PIPE OF AM (NGPA)	10-27-93	09-29-95	8	5
17. NORTHERN NAT GAS	06-11-93	01-24-00	1335	661
18. NRTH AM GAS TRANS (aka ARKLA)	04-01-94	01-12-96	22	7
19. OXY USA	12-05-95	01-20-99	71	17
20. PANHANDLE EASTERN	02-26-93	02-21-97	782	142
21. PLAINS PETROLEUM	09-30-96	01-05-99	17	15
22. REPUBLIC NAT GAS	04-25-94	10-02-96	6	3

TABLE 1: MERCURY METER PROGRAM REPORT (Cont.)

PARTY	DATE INITIATED	DATE FINISHED	# SITES CHARCT	# SITES REMED
23.SUNFLOWER ELECTRIC	03-07-94	06-01-94	1	0
25. TEXACO*	10-19-94	03-02-95	13	9
26. TRIDENT (Former) WARREN (Former) DYNEGY (Current)	02-26-96	12-27-99	602	347
27. TIMBERLAND	01-29-96	02-20-97	43	3
28. UNITED CITIES GAS	11-07-96	11-06-03	342	22
29. VASTAR	11-22-94	08-18-98	65	7
30. WESTERN RESOURCES	10-27-93	01-30-95	166	99
31. WILLIAMS NAT GAS (SOUTHERN STAR)	12-03-95	In Progress	465	192
TOTAL	--	--	6530	2595

NOTE: A good approximation of the total volume of remediated soils can be calculated by multiplying the number of remediated sites by 1.5 cubic yards per site. Approximately 1.0 cubic yard of soil was excavated and remediated at meter stations with concrete floors and 2.0 cubic yards of soil was excavated and remediated at meter houses with earth or gravel floors. Thus, approximately 3892 cubic yards (2573 sites **x** 1.5 cubic yards/site) of soils were remediated.

* TEXACO remediated meter sites prior to KDHE's Mercury Program. KDHE approved Texaco's work.

** The following companies have sites where mercury was used. These companies have not signed an agreement with KDHE, are not currently negotiating an agreement, and are not expected to sign one in the near future. KDHE's files contain no records for these companies.
AMERICAN NATURAL RESOURCES characterized six sites and remediated three.
NEMAHA GAS characterized 20 sites.
CLARK EXPLORATION characterized 23+ sites.

*** PEOPLE'S NATURAL GAS (Currently MISSOURI PUBLIC SERVICE/UTILICORP) has expressed an interest participating in the VCPRP. The company has 743+ sites to be characterized.

To spread costs over a number of years, KDHE permitted companies (especially those with a large number of stations) to conduct characterization and remediation activities in phases. Generally, the companies that proceeded through the program in a timely manner either had fewer sites to manage or had good project managers and/or good consultants. The fact that the ownership of many of the stations has been transferred throughout the existence of this program has complicated matters.

MERCURY CONTAMINATION CHARACTERIZATION AT GAS PIPELINE SITES

This scope of work (SOW) outlines the Kansas Department of Health and Environment (KDHE) minimum requirements for the characterization of gas pipeline mercury manometer sites. Characterization of a mercury manometer site is necessary to fully and accurately determine the need for remediation at each site. This SOW is a flexible process that can be tailored to specific characteristics and needs at individual sites. The requirements of this SOW have been empirically determined by KDHE to be the most effective for determining the nature and extent of mercury contamination at the sites in a consistent and cost effective manner. This SOW must be implemented within the framework of the specific Remedial Section program in which the contamination is being addressed (e.g. Voluntary Cleanup Unit, Site Remediation Unit, etc.). The specific investigative parameters included in this SOW must be incorporated into site characterization work plans submitted to KDHE for KDHE to consider the work plans as candidates for approval.

The overall goal of the site characterization is to identify those metering stations at which mercury is present in or around the facility and to determine the approximate concentrations of mercury present in soils at the sites. The results of soil sampling will be used to determine the need for corrective action at the sites. The Scope of Work must at a minimum include the following activities:

1.0 Historical Evaluation

File reviews should be conducted to determine the age and nature of operations at each metering station. Information should be available in the form of company records or personal narratives from current or former employees as to whether mercury manometers were employed at specific metering stations. A comprehensive list of active and inactive mercury manometer metering stations must be provided to KDHE. At a minimum the list should include the station number, name or other unique identifier, legal description, county, and status (active/inactive). A map indicating the approximate locations of the sites is also recommended.

2.0 Visual Inspections

A visual inspection of those sites that historically employed mercury manometers should be conducted to document existing conditions (building construction, condition of building, nature of the building floor, site drainage, etc.) and to determine the actual locations of all mercury meters that may have been employed at the sites. At a minimum the following conditions must be documented: note whether mercury may have migrated away from the metering station via surface drainage; determine the nature of land use in the vicinity of each site (i.e. are adjacent properties used for residential or recreational purposes, and if so, what is the linear distance to the nearest residence or recreational facility); evaluate shelves, ledges, floors, and other surfaces to determine whether any elemental mercury is present in and/or around the metering stations.

3.0 Mercury Vapor Survey

A Mercury Vapor Analyzer (MVA) should be employed to characterize the concentration of mercury vapor in the breathing zone and near ground level in and around metering stations, adjacent to the chart box, and along the joint between the walls and the footings of the metering stations. At a minimum the following conditions must be documented: calibration procedures and calibration times; and detections of mercury vapors including concentrations, locations, and height above the ground surface of the detections.

Note that if the MVA is properly calibrated, any detection of mercury vapors should be regarded as qualitative only, and usually indicates the presence of much higher concentrations in soils on site than are indicated by the MVA. The detection of mercury vapors in the ambient air on site indicates that the site is a probable candidate for corrective action; further characterization of soils should be performed to determine whether and how much excavation of soils must be performed in order to remediate the site.

4.0 Soil Characterization

Surface and subsurface soil samples should be collected and submitted to a KDHE approved analytical laboratory to characterize the approximate lateral and vertical extent of mercury contamination at the sites. KDHE has determined that a minimum of three samples

must be collected and submitted for laboratory analysis at a meter house with one meter run, whether the site is active or inactive. Approved laboratory methods for total mercury analysis include: 245.5 (Contract Laboratory Program or CLP) and 7471. The TCLP test is described in 40 CFR Part 261 Appendix II - Method 1311. A site at which a mercury meter was historically present cannot be removed from consideration for corrective action unless the minimum three samples have been collected in accordance with KDHE guidance. Additional characterization of metering station sites may expedite the excavation phase of the remedial process; it may be to the facility owner/operator's advantage to collect additional samples above and beyond the required minimum.

The total number and location of soil samples to be collected at each site is based on several specific factors. For the purposes of mercury contamination characterization, metering stations may be grouped into two categories: those with concrete floors, and those with floors composed of dirt, gravel, or other porous materials. All samples should be collected with stainless steel spoons or hand augers and should be collected, handled, and packaged in accordance with appropriate United States Environmental Protection Agency (EPA) guidance.

4.1 In the case of a metering station with a concrete floor, a minimum of three samples should be collected outside each building entrance in the following configuration:

- one grab sample collected at a depth of zero to six inches below grade from a location one foot perpendicular to the center of the door frame;
- one grab sample collected at a depth of 18-24 inches at the same location; and
- one composite sample composed of three or more aliquots collected from depths of zero to six inches at radial distances of three to four feet from the building entrance. The aliquots should be combined in a stainless steel or aluminum pan and blended with a stainless steel spoon prior to packaging.

4.2 In the case of a metering station with a floor composed of materials other than concrete, a minimum of three samples should be collected in conjunction with each mercury manometer that was located in the building. The samples should be collected in the following configuration:

- one grab sample collected at a depth of zero to six inches underneath the former location of each mercury manometer;
- one grab sample collected at a depth of 18-24 inches at the same location; and
- one composite sample composed of four aliquots collected from depths of zero to six inches at radial distances of approximately three feet from the grab sample location.

Sampling locations may be adjusted if existing conditions prevent the collection of the samples at the specified locations.

5.0 Ground Water Characterization

If ground water is encountered during site characterization, a shallow borehole or monitoring well must be emplaced at the metering facility. Two shallow ground water samples (filtered and unfiltered) must be collected and submitted for laboratory analysis for total mercury content using laboratory methods 245.1 (CLP), 245.2 (CLP), or 7470. KDHE should be notified of the presence of shallow ground water prior to the commencement of drilling or sampling activities at any site.

6.0 Mercury Characterization Report

At the conclusion of the characterization phase an abbreviated characterization report must be submitted to KDHE. The characterization report should include: a summary of findings including analytical data, site setting, and a list of corrective action candidate sites; county maps with marked and labeled metering station locations; copies of field assessment sheets (including sketches of the stations indicating dimensions, features, mercury manometer locations, and sampling locations); copies of laboratory analytical reports; and quality assurance/quality control results and interpretation.

A natural gas pipeline mercury manometer site owner/operator may formulate a mercury site characterization plan using a sampling strategy other than that outlined above; however, any such variance must be justified to and approved by KDHE prior to implementation. Failure to meet or exceed KDHE standards in the implementation of site characterization may result in the invalidation of site characterization efforts.

For additional information or questions concerning this SOW or other aspects of natural gas pipeline mercury manometer characterization or cleanup, please call or write:

Rick Bean, Remedial Section Chief
Kansas Department of Health and Environment
Bureau of Environmental Remediation
1000 SW Jackson, Suite 410
Topeka, KS 66612
(785) 296-1675

MERCURY CONTAMINATION REMEDIATION AT GAS PIPELINE SITES

1.0 INTRODUCTION

This Scope of Work (SOW) outlines the Kansas Department of Health and Environment (KDHE) requirements for the remediation of mercury-contaminated natural gas pipeline mercury manometer sites. The SOW specifically does not apply to non-mercury type contamination at natural gas metering sites. The objective of the remediation effort is to cleanup any metering station having visible mercury present in or around the natural gas manometer station and/or to reduce the mercury contamination in soil to levels that are deemed to be adequately protective of human health. All mercury impacted soil must be remediated to meet the residential RSK Tier 2 cleanup standard of 2.0 mg/Kg to be eligible for unrestricted site closure. Any residual mercury impacts left in soil above the residential standard will either require active remediation or the implementation of environmental use controls (EUCs) at the site. The requirements of this SOW have been determined by KDHE to be effective for remediation sites with mercury contamination in excess of approved levels in a consistent and cost effective manner. The elements outlined herein must be incorporated into a Remediation Work Plan and submitted to KDHE for review. Final approval of the Remediation Work Plan shall be contingent upon satisfying the elements contained in this SOW. This SOW must be implemented within the framework of the specific Remedial Section program in which the contamination is being addressed (e.g. Voluntary Cleanup Unit, Site Remediation Unit, etc.).

Mercury remediation will include, at a minimum, the following elements: characterization of excavated waste; removal of visible mercury and excavation of contaminated soils; confirmation and verification sampling; backfilling, grading, restoration of excavated area; and disposal of contaminated soils in a manner consistent with applicable regulations. The Remediation Work Plan must contain the following: a summary of characterization (including a list of sites requiring remediation and an implementation schedule), proposed remediation and disposal methodology, a verification sampling plan(s), a site restoration plan, a quality assurance project plan, and a health and safety plan.

Toxicity Characteristic Leaching Procedure (TCLP) analysis must be used to determine the appropriate disposal method of in accordance with the Resource Conservation and Recovery Act (RCRA). The TCLP test is described in 40 Code of Federal Regulations (CFR) Part 261 Appendix II-Method 1311. Critical to TCLP analysis is its representativeness of the potential hazardous waste. RCRA regulation 40 CFR 261.24, Subpart C states:

"(a) A solid waste exhibits the characteristic of toxicity if, using the test methods described in Appendix II or equivalent methods approved by the Administrator under the procedure set forth in §§ 260.20 and 260.21, the <u>extract from a representative sample of the waste</u> contains any of the contaminants listed in Table I at a concentration equal to or greater than the respective value given in that Table."

KDHE interprets "representative sample of the waste" to mean a sample obtained from the excavated waste at each individual site and not from a stock pile of excavated waste from multiple sites.

The Remediation Work Plan should include a discussion of the following activities:

2.0 SUMMARY OF CHARACTERIZATION

The summary should include a brief review of the initial characterization activities. Sites with total mercury in excess of KDHE's established cleanup levels should be listed in an appendix. The list should include:

- station number, name, or other unique identifier
- legal description
- county
- total mercury analysis results
- land use
- status (active/inactive). A proposed schedule for remediation of each site should be included.

3.0 REMEDIATION TECHNOLOGY

The treatment and disposal method selected for mercury-bearing wastes depends on the classification of the wastes according to RCRA guidelines. New and innovative remedial technology designed for pre-treatment and/or treatment of mercury-contaminated soils (non-hazardous) or characteristic hazardous waste will be considered provided they can meet KDHE cleanup criteria and obtain all necessary RCRA and KDHE (Bureaus of Air & Radiation, Waste Management, and/or Water) authorizations or permits, if any. The intent to recycle recovered free/elemental mercury must be stated in the remediation work plan and approved by KDHE. Additionally, the Work Plan should designate the recycling facility. Possible waste classifications include:

3.1 Non-hazardous waste classification:

TCLP analysis results are less than 0.2 mg/l; total mercury analysis results are used to determine if the non-hazardous waste will require remediation. Note: TCLP analysis are not required if the total mercury concentrations are less than 4.0 mg/kg. For the cleanup of non-hazardous mercury-contaminated soils, the approved remediation methodology includes excavation and disposal of contaminated soils at an approved Subtitle D (sanitary) landfill. Appendix A contains a map illustrating the various landfills within Kansas. Natural gas pipeline owner/operator must obtain a solid waste disposal authorization prior to landfilling material of this nature in Kansas. Please direct questions or requests for solid waste disposal authorization to the KDHE’s Solid Waste Section.

The use of mobile treatment units (MTUs) to treat non-hazardous mercury-contaminated soil for remediation will be considered provided the treated soil meets KDHE cleanup levels. Companies contemplating the use of MTUs should contact KDHE Ys Bureau of Air & Radiation, Air Engineering Section, to acquire "special approval" concerning the MTUs air emissions. The MTUs can be operated at individual sites or at a centrally located facility. Treated soils meeting the cleanup levels may be returned to the place of origin with appropriate laboratory verification. Since Kansas cleanup levels are health risk based, federal regulations, directives, and policy would allow for the decontaminated material to be returned to its place of origin.

The recovered component (elemental mercury) would remain subject to regulation as a hazardous waste. A temporary United States Environmental Protection Agency (EPA) identification number will be required in order to transport the recovered mercury to an approved treatment, storage, or disposal facility (TSDF). The temporary EPA identification number is good for thirty days once activated, and can be obtained by contacting KDHE’s Hazardous Waste Section (HWS). Manifests and other shipping requirements for the transportation of recovered mercury intended for recycling should be arranged directly with the recycling facility, with the recycler assuming possession of the mercury at the site.

3.2 Characteristic hazardous waste (low total mercury content)

TCLP analysis results are greater than 0.2 mg/l; total mercury analysis results are less than 260 mg/kg. The approved remediation methodology includes excavation and disposal of hazardous soils at an approved TSDF. Hazardous waste authorizations are not required, a temporary EPA identification number must be obtained.

The use of on-site MTUs to process contaminated soils exhibiting a characteristic hazardous waste classification (low total mercury content) is permissible. 40 CFR 268.7(a)(4) contains provisions for the treatment of a prohibited waste (i.e. D009) in tanks or containers regulated under 40 CFR 262.34 in order to meet applicable Land Disposal Restriction (LDR) treatments standards. The provisions of 40 CFR 262.34 and 268.7(a)(4) exempt the on-site treatment activity only from most hazardous waste permitting requirements. Companies contemplating the use of a MTU should contact KDHE's Hazardous Waste Section regarding the waste analysis plan (required by 40 CFR 268.7(a)(4)(i)) and clarification of permitting issues regarding MTUs. As noted previously, the Bureau of Air & Radiation should also be consulted to determine if "special approval" will be required.

Federal regulations, directives, and policy allow for the decontaminated medium to be placed back into its place of origin because Kansas cleanup levels are health risk based. KDHE will consider the application of "contained-in" remediation for any mercury characteristic waste to allow for the return of decontaminated soil to the place of its origin. Since the hazardous characteristic has been removed from the material the LDR does not apply.

The recovered component (elemental mercury) would remain subject to regulation as a hazardous waste. In order to transport the recovered mercury to an approved TSDF, a temporary EPA identification number will be required. Manifest and shipping requirements, for elemental mercury recovered and intended for recycling, should be arranged directly with the recycling facility with the recycler taking possession of the mercury at the site.

3.3 Characteristic hazardous waste (high total mercury content)

TCLP analysis results are greater than 0.2 mg/l; total mercury analysis results are greater than 260 mg/kg. Under 40 CFR Part 268, the LDR lists the recommended remediation technology for characteristic hazardous waste as the best demonstrated available technology (BDAT). The RCRA specified BDAT treatment is roasting or retorting.

The use of on-site incinerator or retort MTUs, to process contaminated soils exhibiting a characteristic hazardous waste classification with high total mercury content to a hazardous waste classification with low total mercury content, is permissible. 40 CFR 268.7(a)(4) contains provisions for the treatment of a prohibited waste (i.e. D009) in tanks or containers regulated under 40 CFR 262.34 in order to meet applicable LDR treatments standards. The provisions of 40 CFR 262.34 and 268.7(a)(4) exempt the on-site treatment activity only from most hazardous waste permitting requirements. As noted above, the waste analysis plan (required by 40 CFR 268.7(a)(4)(i)) and permit issues must be submitted to the Hazardous Waste Section. The Bureau of Air & Radiation should also be consulted to determine if "special approval" will be required.

The resulting MTU processed soil will be considered hazardous waste and will require disposal at an approved TSDF. A temporary EPA identification number will be required to transport the recovered, processed low mercury content hazardous waste to an approved TSDF.

3.4 D009 (free/elemental mercury)

All recovered free/elemental mercury. Metering houses having visible free mercury on the floors, walls, cracks, or any other location in or around the building shall be cleaned using one or a combination of the following methods: a mercury vacuum equipped with high efficiency particulate air (HEPA) filter or its equivalent, mercury absorbent sponges, and/or similar mercury reclamation equipment. If the

reclamation equipment containing the recovered mercury is not fully saturated, exhausted, or filled, they may be used at other site(s) until they are completely saturated, exhausted, or filled. The recovered component (elemental mercury) would remain subject to regulation as a hazardous waste and a temporary EPA identification number will be needed to transport the recovered mercury to a TSDF. Manifests and other shipping requirements for recovered mercury intended for recycling should be arranged directly with the recycling facility, with the recycler taking possession at the site.

4.0 SOIL REMEDIATION

Procedures for the remediation of contaminated soil outlined herein are for the "ideal" metering station. Variations from the procedures listed may be necessary depending on the physical characteristics of or at each metering station. However, the procedures outlined should be followed as closely as possible with all major deviations documented and noted in the final remediation report. The recommended remediation procedures are:

4.1 Shallow contamination (0 to 6 inches)

The recommended initial vertical cut of soil to be removed is 12 inches, with subsequent cuts at six inches minimum. Confirmation and verification sampling are to be conducted as outlined in the Sampling Plan (Section 4). Verification samples with total mercury concentrations greater than (or exceeding) the cleanup levels will dictate the location(s) (lateral or vertical) for additional cuts of soil. When the confirmation sample results are below cleanup requirements, verification samples will be collected and submitted to an approved analytical laboratory for total mercury analysis. If the results of the total mercury analysis are below established cleanup levels, no further excavation will be required.

4.2 Deep contamination (18 to 24 inches)

The recommended initial cut of soil to be removed is 24 inches, with subsequent cuts at a six inch minimum. Confirmation and verification sampling are to be conducted as outlined by the Sampling Plan (Section 4). Verification samples with mercury above the cleanup levels will dictate the location (lateral or vertical) for future cuts of soil. When the confirmation sample results are below cleanup requirements, verification samples will be collected and submitted to an approved analytical laboratory for total mercury analysis. If the results of the total mercury analysis are below established cleanup levels, no further excavation will be required.

4.3 Area of initial excavation

The recommended size or area of the initial excavation will depend upon the location of the contaminated soil relative to the metering house.

4.3.1 Remediation outside the metering house:

Sites where the metering house has\had a constructed floor (i.e. concrete, metal, or wood), the minimum area of excavation should be:

- for grab sample locations in excess of cleanup levels, an area from the entrance to one foot beyond the grab sample location and not less than two feet wide;

- for composite sample locations in excess of cleanup levels, the area to be excavated should be a radius of not less than two feet from the entrance, out to five feet; or

- if both sample type locations are in excess of cleanup levels, a radius of five feet from the entrance.

Actual area of excavation should be adjusted depending upon the actual location of the original characterization sample(s) or due to the presence of major obstructions. All deviations from the

recommended excavation procedures must be clearly documented in the final report. Surface gravel covering in the excavation area should be removed and the area adjacent to the excavation covered with 6-mil polyethylene sheeting during remediation activities. Cover materials removed may need to be disposed of as special waste if free or visible mercury is present within it.

4.3.2 Remediation inside the metering house:
At sites where the present or former metering house did not have a constructed floor (concrete, metal, or wood), the minimum area of excavation is dependent upon the type of sampling technique used in the characterization investigation (grab, composite, or both sample(s) indicating mercury in the soil in excess of remediation criteria at the site). The recommended minimum area of excavation is:

- at grab sample locations in excess of cleanup levels, a radius of one and a half feet around the former meter or sample location;

- for composite sample locations in excess of cleanup levels, a radius of not less than one and a half feet to four and a half feet; and

- for both sample type locations in excess of cleanup levels, a radius of not less than four and a half feet from the meter or sample location shall be excavated.

The area of excavation maybe adjusted depending on the location of original characterizing sample(s) or due to the presence of major obstructions. All deviations from the recommended excavation procedures must be clearly documented in the final report. Removed cover materials may need to be disposed of as special waste if free or visible mercury is present or there is other evidence suggesting contamination.

4.3.3 Restrictive Conditions:
Conditions may arise limiting the feasibility and extent of remediation. These conditions should be documented, noted in the final report, and reported to KDHE as they occur. Conditions that might limit further excavation include:

- Reaching bedrock,

- Encountering ground water during excavation. If ground water is encountered during the excavation, two representative ground water samples (one filtered and one unfiltered) must be collected and analyzed using method EPA-600/4-82-055. Within 24 hours of encountering ground water and collecting ground water samples, KDHE must be notified. If the analysis indicates the presence of mercury, a work plan must be developed and submitted to KDHE for approval to characterize the nature and extent of ground water contamination.

- Operational considerations (to ensure safety of workers or other individuals or to protect the integrity of pipeline equipment and facilities) may be grounds to suspend further excavation. KDHE must be notified immediately of any operational considerations impacting the excavation activities. KDHE may require an alternative remedial activity to protect human health and the environment at such sites. Operational considerations that impact the remediation work plan must be documented and noted in the field log sheet and in the final report.

4.3.4 Removal of excavated soils:
All contaminated soils excavated before the TCLP analytical results are received, must remain on site until the project manager receives the results. The analytical results are necessary before the project manager can properly classify the waste for appropriate treatment or disposal options. The use of temporary staging areas to store excavated waste prior to receipt of TCLP analytical results will be permitted but a temporary EPA identification number will be required for each staging area. Inquiries

about the requirements and arrangements necessary for obtaining a temporary EPA identification number to establish a temporary staging area should be made to the Hazardous Waste Section.

5.0 SOIL SAMPLING PLANS

All samples should be collected with stainless steel spoons, Shelby tubes, hand trowels, or hand augers and should be collected, handled and packaged in accordance with appropriate EPA guidance. All TCLP analysis for waste characterization shall be performed at a Kansas Certified Laboratory in accordance with Kansas Administrative Regulation 28-31-4(b)(3). The approved methods for total mercury analysis include: 245.5 (Contract Laboratory Program or CLP) and 7471. The TCLP test analysis is described in 40 CFR Part 261 Appendix II - Method 1311. However, verification sampling for total mercury analysis of the non-excavated soil can be conducted at a non-Kansas certified laboratory provided specific KDHE approval is received. The following sampling plans shall be submitted with the Remediation Work Plan and implemented as required:

5.1 Characterization for disposal sampling plan

In accordance with RCRA and Kansas Administrative Regulations, characterization for disposal will be conducted on all excavated material from sample locations exceeding KDHE established cleanup standards. Samples must be collected from the containerized waste (i.e. soil bag, drums, or other such containers) on site. Two composite samples will need to be collected to satisfy requirements for waste characterization. One composite sample will be for TCLP analysis and the second for total mercury. Excavated waste that fails TCLP analyses will require subsequent total mercury analyses to determine if the waste will be classified as high or low total mercury hazardous waste. Composite samples shall be comprised of one aliquot from each container (soil sack, drums, or other holding unit) used/filled at each site (i.e. if five sacks are generated, then a five point aliquot will be used for the composite samples; if three sacks are generated, then a three point aliquot will be used; or if ten drums are filled, a ten point aliquot will be used).

5.2 Confirmation sampling plan

Confirmation sampling is intended as a field screening technique of the non-excavated soil for the purpose of characterizing the presence of residual mercury, if any; and to help insure subsequent verification sampling will validate a site has been successfully remediated below cleanup levels and to alleviate or minimize the necessity to return to the site for remedial excavation. The use of a mercury vapor analyzer (MVA) or similar device in conjunction with a heated headspace analysis is recommended. If mercury is detected during field screening at a level suggesting residual mercury contamination exceeding KDHE's cleanup levels, an additional cut of soil will be required. Confirmation sampling and excavation must continue until the mercury concentration in the soil is below the cleanup levels. Appendix B contains a scenario for confirmation sampling using a MVA.

5.3 Verification sampling

Verification samples will be collected for laboratory analysis when the confirmation samples indicate the mercury concentration in the soil is below the cleanup criteria. Samples will be collected in the same area where the confirmation samples were collected (the final sidewall samples should be collected no closer than six inches from the top of the excavation). A minimum of three composite samples including: 1) two composite sidewall samples (from opposite or adjacent sides), and (2) a composite of the bottom of the excavation (four aliquots from each quarter section of the bottom) will be sent to a laboratory for total mercury analyses. Variation from the number of prescribed samples may be necessary depending upon the final geometry of the site excavation. KDHE will consider alternative sampling scenarios; however all alternate sampling scenarios must be approved by KDHE prior to implementation. If total mercury analyses are below cleanup criteria, no further excavation will be required. If additional cuts of soil are determined necessary, verification samples from walls and/or base area already satisfying KDHE's

cleanup levels are not required. Verification samples are necessary only from the areas of additional excavation.

5.4 Backfill Soil Verification Sampling

One composite sample must be collected from any source of backfill material and analyzed for total mercury before that material is deposited in the excavation. A minimum of one composite sample from each source of backfill material will be required to verify the backfill source is below KDHE cleanup levels. If the backfill material is treated soil from a mobile treatment facility, and the soil is remediated to below the cleanup levels, it can be returned to the site upon verification by a total mercury analysis for every ten cubic yards treated.

6.0 BACKFILLING

Upon receipt of the verification sampling analysis and the backfill soil verification analysis results, the excavated areas can be filled and compacted to original ground levels. Surface covering removed prior to excavation may be placed over filled areas if the material was not present during the use of the mercury manometer or is non-contaminated (i.e. no visible mercury on any of the material). The area should be returned to its original state.

7.0 MERCURY REMEDIATION REPORT

At the conclusion of the remediation phase, a final verification report for the project must be submitted to KDHE. The report should include as a minimum:

- summary of findings;
- regional locator maps for each station, site setting, photographs, copies of field log sheets, scaled site maps (including sampling locations, areas of excavation, sketch of excavation noting dimensions and features), any major deviations from the Work Plan due to physical conditions at the site, and operational considerations documentation;
- summary of excavation quantities and restoration activities, including type of backfill material (i.e. treated or non-treated);
- field screening sample methods and collection data;
- copies of all laboratory analytical reports;
- quality assurance/quality control results;
- final disposition or fate of all treated or landfilled waste, as well as recycled mercury; and
- copies of other relevant site data for the remediation phase.

A natural gas pipeline mercury manometer site owner/operator may formulate a mercury site remediation plan using a sampling and remediation strategy other than outlined above; however, the plan must be approved by KDHE prior to implementation. For additional information or questions concerning this SOW or other aspects of KDHE's natural gas pipeline mercury manometer remediation program, please call or write:

Rick Bean, Remediation Section Chief
Kansas Department of Health and Environment
Bureau of Environmental Remediation
1000 SW Jackson, Suite 410
Topeka, KS 66612
(785) 296-1675

Appendix A

Landfills in Kansas

Attached is a map illustrating the counties with landfills and the type of landfill available. Due to the recent and continued turnover of landfills closing and/or opening, an accurate listing of landfills within Kansas is unavailable. Companies contemplating the use a Subtitle D landfill in their remediation plans can obtain specific information regarding landfills in a specific area from:

- The local County Engineer from the county(s) of interest; and

- The companies local pipeline facility(s) within Kansas (many local pipeline facility(s) are regularly obtaining disposal authorization from KDHE's Solid Waste Section and are aware of the landfills in the area and their specific requirements).

If the landfill contacted has any concerns regarding the material to be disposed of, they should be encouraged to contact KDHE's Solid Waste Section.

Appendix B

Field Screening

The following sampling scheme is presented as a possible technique for field screening based on field work conducted during previous mercury remediation by natural gas pipeline companies. KDHE recognizes other scenarios may be more appropriate at some sites and acknowledges the need to modify the field screening methodology as the remediation project progresses. It should be noted, employment of liberal field screening parameters may result in excessive return visits (increasing the cost and time involved per site) for further remedial activity. If conservative field screening parameters are employed, over excavation at a site may occur. For this reason, adjustments to the field screening should be considered as verification results become available. The scheme presented relies on the use of a MVA. KDHE is not specifically endorsing the MVA, and is aware of its limitations; however KDHE, through past experience, believed the MVA, if used properly, is a cost and time effective field screening instrument. As noted in the SOW, the use of alternate screening instruments is at the discretion of each company.

At the point were the project manager determines excavation activities remediated the site to below cleanup levels or has met the minimum recommended excavation outlined in the SOW, the field screening should commence. For field screening, KDHE recommends a visual inspection and a MVA scan of the excavation followed by a heated head space analysis.

A. Visual Inspection and MVA Scan:

1. A careful inspection for free mercury along the walls and base of the excavation should be conducted. Appropriate personal protection equipment should be considered.

2. Using a MVA, the walls and base of the excavation should be assessed. The project manager can determine the MVA response that constitutes “clean” for field screening. Two possible methods are:

a. Obtain a sample of soil from a laboratory with a known concentration of mercury and calibrate the MVA via a heated head space analysis outlined below; or

b. The MVA units (mg/m^3) can be converted to total mercury (mg/kg) by the following equation following Avogadro's Law:

$\Phi g/m^3$ = [(ppm by volume) x 1000 x Molecular Weight] ÷ 24.4

3. If either the visual inspection or MVA scan of the excavation indicate mercury present, additional excavation cuts should be considered. If the visual inspection and MVA scan does not indicate the presence of mercury, the heated headspace analysis should be conducted.

B. Heated Head Space Analysis:

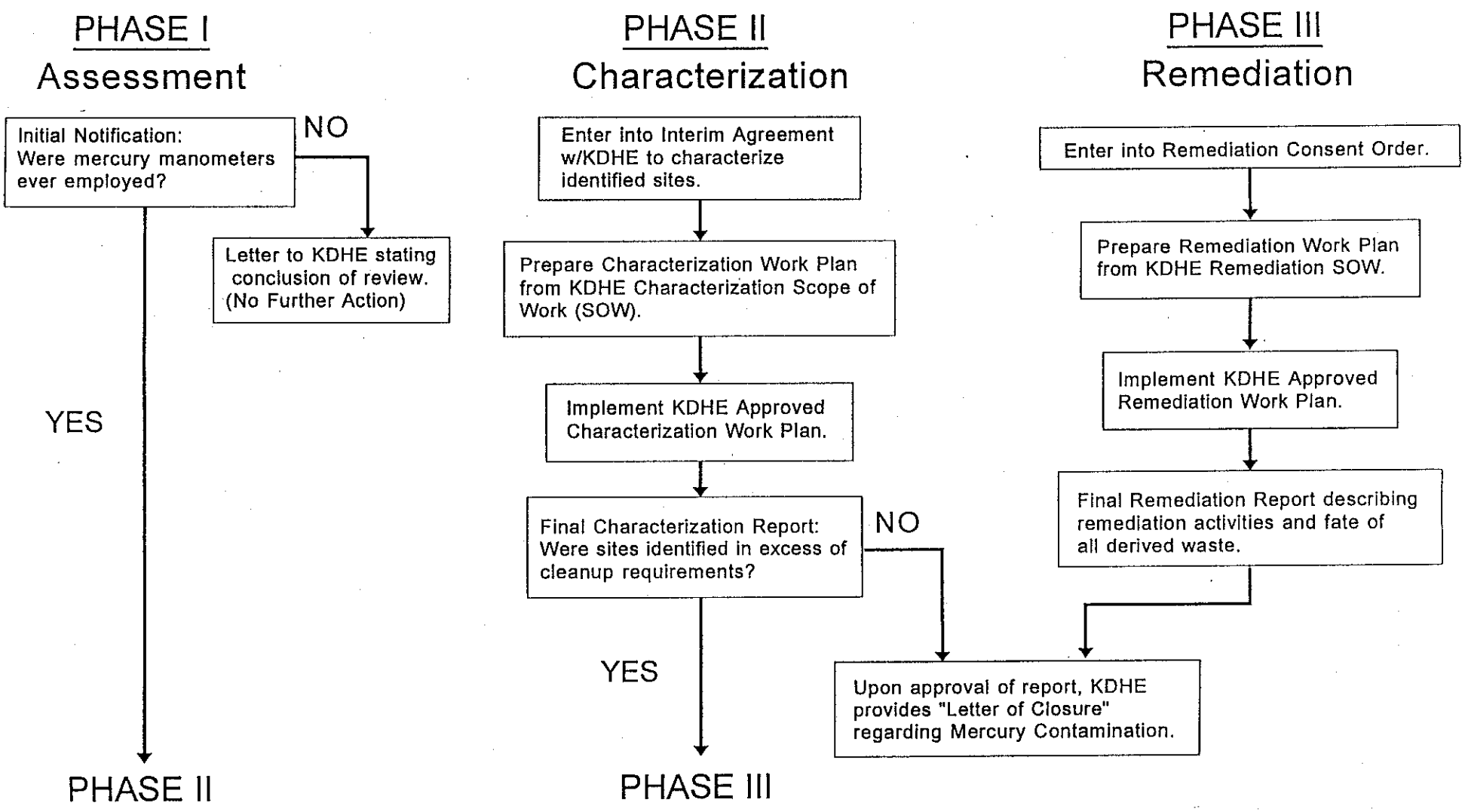
1. Minimum of five grab samples per excavation (one from each excavation wall and one from the base) should be tested using a one-liter glass sample jar fitted with a temperature probe and a sample port.

2. Soil must be mixed to loosen and blend the soil before placing it in the glass jar. The soil and jar should be heated to 85EF for a minimum of 5 minutes.

3. The calibrated MVA probe should then be inserted into the sample port to quantify the concentration of mercury within the jar headspace.

4. If the head space analysis indicates mercury is present above the cleanup level, additional excavation cuts are recommended. Subsequent visual inspection, MVA scanning, and headspace analysis need be conducted only on the additional excavation area. When the heated headspace analysis indicates mercury concentrations are below KDHE's cleanup level, verification sampling should commence (see Section 4(C) in the SOW).

KANSAS MERCURY PROGRAM
FOR NATURAL GAS MERCURY MANOMETER SITES



Kansas Department of Health and Environment

Bureau of Environmental Remediation, Remedial Section

State Cooperative Program

Mercury Manometer Program

Background:
Kansas has been a leading natural gas producing state since the early 20th Century. From its inception, the natural gas industry has used mercury manometers extensively to monitor gas pressure and flow at wellheads, gathering systems, facilities, and transmission/distribution lines. Elemental mercury was inadvertently released at a number of these meter stations as a result of maintenance operations, equipment failure, vandalism, and operator error. Given the long, unregulated history of natural gas production in Kansas, KDHE/BER recognized that there were potentially thousands of mercury contaminated stations. Research into potential threats to human health indicated that the most immediate health concern was the exposure of workers to mercury vapors. Over a number of years, workers servicing meters could potentially receive significant cumulative exposure from contaminated meter stations.

Solution:
Given the potential magnitude of the problem, KDHE/BER initiated the Mercury Manometer Program in 1993 and charged the State Cooperative Program with management responsibilities. The Mercury Manometer Program evolved into a three phase approach. The first phase, Phase I, was the Site Assessment phase that initiated the process. During Phase I, natural gas companies operating in Kansas were requested to identify all stations where mercury had been or was currently used. Approximately 10,000 stations were assessed and 6,530 of these were identified as sites that used mercury. These sites were characterized through the Site Characterization phase, Phase II, which is conducted under an Agreement between each operator and KDHE. A work plan was developed consistent with KDHE's Scope of Work (SOW) which outlines sampling strategies for the sites.

Remedial activities at a typical meter station.

Most excavation can be done through manual techniques.

Once all the stations had been characterized a final report was submitted to KDHE/BER summarizing the findings. To date 2,595 sites have been characterized as requiring remediation. These sites were remediated during the Site Remediation phase, Phase III, which was conducted under a Consent Order agreement between each operator and KDHE. Generally the contaminated soil was excavated and a composite sample was analyzed to determine if the soils were hazardous and to evaluate which remedial technique to employ. A Remediation SOW developed by KDHE outlined four possible remedial strategies, including soil treatment that allowed treated soils to be returned to the site, or off-site disposal of contaminated soils. The extent of the excavation was determined through field screening and verification sampling. A final report was submitted to KDHE/BER and the Consent Order would be terminated. As of June 2010 only one site remains to be remediated and should be completed in 2011. Additional companies that operate within Kansas have expressed interest in participating in the Mercury Manometer Program to characterize their manometer stations in the future.

Excavated soil placed into soil bags awaiting characterization for disposal.

Benefits:

- **Health risk to workers eliminated.**
- **An estimated 10,000 sites assessed, 6,530 sites identified as potentially impacted through historic use of mercury.**
- **2,595 sites characterized as requiring remediation, 2,594 cleanups completed as of 2010.**
- **Approximately 4,000 cubic yards of soil remediated.**

Prepared by the Kansas Department of Health and Environment, Bureau of Environmental Remediation, Remedial Section. July 16, 2010.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

RECEIVED
SEP 21 1993
BUREAU OF ENVIRONMENTAL REMEDIATION

SEP 20 1993

Mr. Louis P. Soldano
Senior Counsel
Enron
Northern Natural Gas Company
1400 Smith Street
Houston, Texas 77002-7369

Dear Mr. Soldano:

Re: Remediation of Northern Natural Sites in Nebraska and Iowa

We have received your letter dated August 20, 1993, which outlines the remediation approach that Northern Natural Gas Company (Northern) is proposing for mercury contamination at sites in Nebraska and Iowa. I appreciate your efforts to coordinate with this Agency. The following comments address key issues which affect your activities.

We are unable at this time to fully participate in the review and approval process for mercury remediation at the pipeline sites. We recommend that you conduct your cleanups in coordination with the states and in a consistent manner throughout Region VII. By being consistent, it displays a good faith effort on your part to ensure thorough cleanups, regardless of the level of state oversight.

We are familiar with the mercury cleanups being conducted in Kansas with the oversight of the Kansas Department of Health and Environment (KDHE) and believe that the approach by KDHE is a sound one. The cleanup levels established are within the range accepted by the Agency and recommended in the Resource Conservation and Recovery Act (RCRA) proposed rule. The only difference in cleanup levels are residential and recreational levels (2.0 milligrams per kilogram [mg/kg] as opposed to 20 mg/kg). Your letter stated that you are willing to clean to a lower level (less than 20 mg/kg) in residential areas, which is consistent with the cleanups in Kansas. This protective

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approach makes sense to ensure that the sites will not need to be revisited, especially in light of the fact that no one single soil cleanup level has been established, and because cleanup levels should be adjusted to meet site-specific circumstances.

The approach used by KDHE includes many of the elements that ensure a sound cleanup (reliable analytical services, thorough investigation and remediation efforts) will be met and will help to ensure successful cleanups in each of the states in this Region.

Again, we encourage you to maintain communication with the affected states. We recommend that you submit your work plans to the appropriate state agency and provide them with adequate notice prior to conducting your field work. We also recommend that you develop a "fact sheet" to be shared with the community and local officials which describes your efforts. Voluntary cleanups by any industry, conducted in a sound manner using EPA or state guidelines, have been well received.

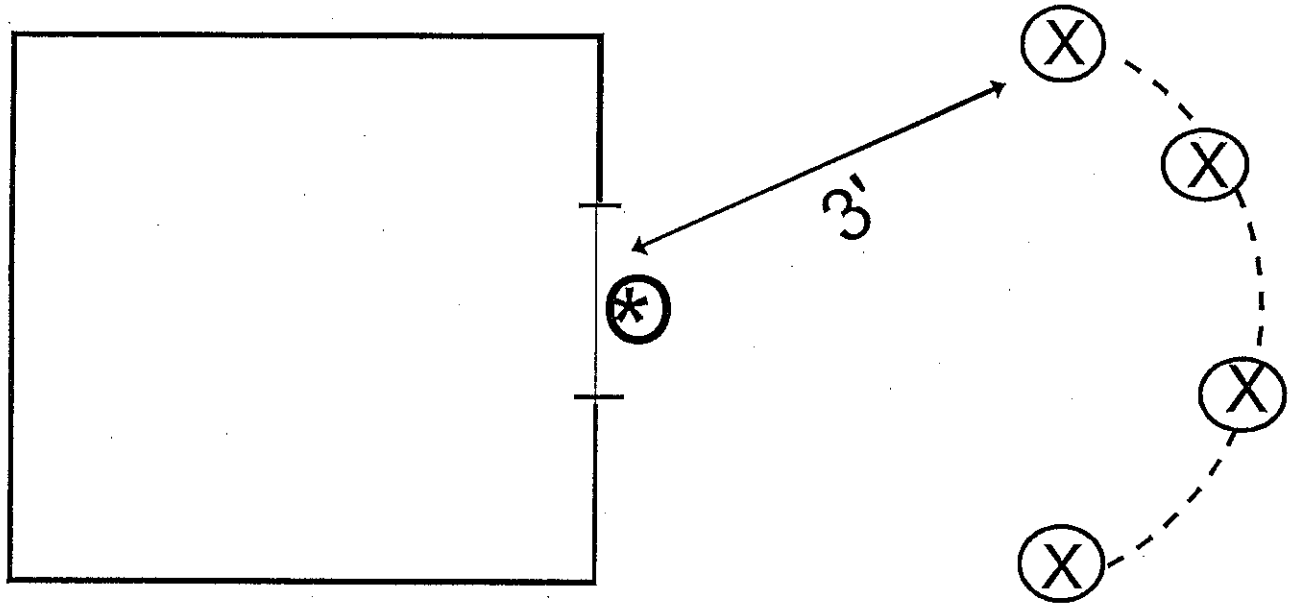
If you have any questions or need additional information, please feel free to contact Shelley Brodie, of my staff, at (913) 551-7706.

Sincerely,

David A. Wagoner
Director
Waste Management Division

cc: Rick Bean, KDHE
Ed Sadler, MDNR
Richard Schlenker, NDEQ
Lavoy Haage, IDNR

Concrete or Steel Floor

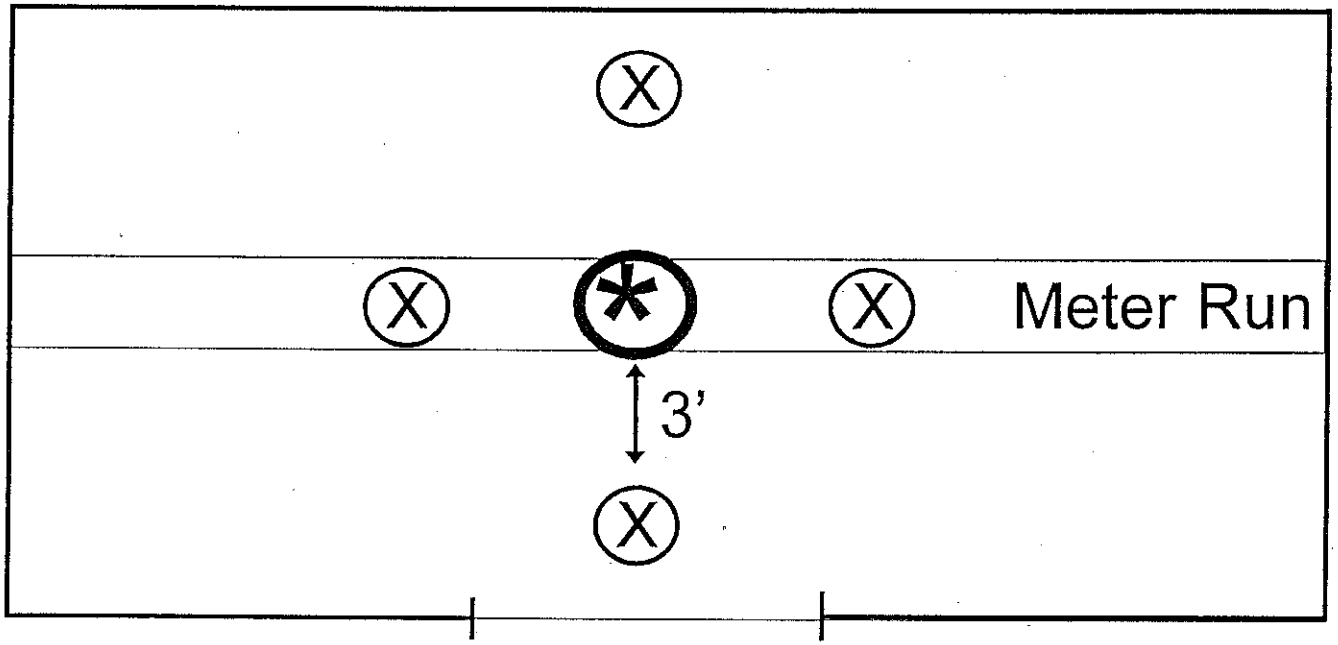


O Shallow Grab Sample (0 - 6")

* Deep Grab Sample (18 - 24")

Ⓧ Shallow Composite Sample Fractions (0 - 6")

Dirt Floor



Former Mercury Meter Location, Shallow and Deep Grab Samples (0-6", 18-24")

Shallow Composite Sample Fractions (0-6")

Excavation at CIG Loucks #2

CIG Loucks #2

Excavation at CIG-Lakin

Excavation at CIG-Lakin

Excavation – CIG Lakin

Sampling – CIG Lakin

Excavation – ANR Pipeline