Certification Reports

Results of Performance Evaluation Conducted According to the E.P.A. Test Procedures

Pressurized Line Leak Detection System and Wireless Pressurized Line Leak Detection System

Manual Number 576013-308, Revision D

Contents:

❏ Monthly Test: Pressurized Line Leak Detector (Fiberglass Pipeline) Series 8484 (PLLD)

❏ Hourly Test: Pressurized Line Leak Detector (Flexible Pipeline) Series 8484 (PLLD)

❏ Line Tightness Test: Pressurized Line Leak Detector (Flexible Pipeline) Series 8484 (PLLD)

❏ Hourly Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8484 (PLLD)

❏ Line Tightness Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8484 (PLLD)

❏ Hourly Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8494 (WPLLD)

❏ Monthly Monitoring Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8494 (WPLLD)

❏ Line Tightness Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8494 (WPLLD)

VEEDER-ROOT
Environmental Products

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Monthly Monitoring Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems.* This full evaluation report includes eight attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name:__Veeder-Root Pressurized Line Leak Detector__

Version of System:__Series 8484__

Manufacturer Name:__Veeder-Root__

__125 Powder Forest Drive, Post Office 2003__
(street address)

__Simsbury, CT 06070-2003__
(city, state, zip code)

__(203) 651-2700__
(telephone number)

Evaluation Results

1. The performance of this system
    (X) meets or exceeds
    ( ) does not meet
    the federal standards established by the EPA regulation for monthly monitoring tests.

    The EPA regulation for a monthly monitoring test requires that the system be capable of detecting a leak as small as 0.2 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2. The estimated P_{FA} in this evaluation is __0__ % and the estimated P_D against a leak rate of 0.2 gal/h defined at a pipeline pressure of __30__ psi (the normal operating pressure) in this evaluation is __100__ %. The system was actually tested at an average calibrated leak rate of __0.195__ gph (at __30__ psi) and it detected __100__ % of induced leaks.

Criterion for Declaring a Leak

3.   This system
     (X) uses a preset threshold
     ( ) measures and reports the output quantity and compares it to a predetermined threshold to
     determine whether the pipeline is leaking.

4.   This system
     (X) uses a single test *(1 test after accounting for effects of thermals, if any)*
     ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests
     required) separated by _____ hours (specify the time interval between tests) to determine
     whether the pipeline is leaking.

5.   This system declares a leak if the output of the measurement system exceeds a threshold of
     _0.17_ (specify flow rate in gal/h) in _1_ out of _1_ tests (specify, for example, 1 out of 2,
     2 out of 3). Please give additional details, if necessary, in the space provided.

     _____

     _____

Evaluation Approach

6.   There are five options for collecting the data used in evaluating the performance of this
     system. This system was evaluated
     (X) at a special test facility (Option 1)
     ( ) at one or more instrumented operational tank facilities (Option 2)
     ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
     ( ) at 10 or more operational storage tank facilities (Option 4)
     ( ) with an experimentally validated computer simulation (Option 5).

7.   A total of _23_ tests was conducted on nonleaking pipeline(s) between _9/23/96_ (date) and
     _9/27/96_ (date). A description of the pipeline configuration used in the evaluation is given
     in Attachment 3. *(These tests supplemented a full set of 53 tests conducted earlier on the
     related Series 8494 system. See Attachment 8 for further testing details.)*

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8.   The pipeline used in the evaluation was _2.22_ in. in diameter, _249_ ft long and
     constructed of _fiberglass_ (fiberglass, steel or other).

9.   A mechanical line leak detector
     ( ) was
     (X) was not   *System has a 3 gal/h test mode, whose function*
     present in the pipeline system.   *replaces that of a mechanical leak detector.*

Answer questions 10 and 11 if Option 3 or 4 was used.

10. The evaluation was conducted on _____ (how many) pipeline systems ranging in diameter
     from _____ in. to _____ in., ranging in length from _____ ft to _____ ft, and
     constructed of _____ (specify materials).

11.   A mechanical line leak detector
        ( ) was
        ( ) was not
        present in the majority of the pipeline systems used in the evaluation.

12.   Please specify how much time elapsed between the delivery of product and the start of the
        data collection:
        ( ) 0 to 6 h
        ( ) 6 to 12 h   *(Not applicable)*
        ( ) 12 to 24 h
        ( ) 24 h or more.

Temperature Conditions

    This system was evaluated under the range of temperature conditions specified in Table 1.
The difference between the temperature of the product circulated through the pipeline for 1 h or more
and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is
summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product
temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4
was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used[a]	Range of ΔT (°F)[b]
1	2	$\Delta T < -25$
4	4	$-25 \leq \Delta T < -15$
5	4	$-15 \leq \Delta T < -5$
5	2	$-5 \leq \Delta T < +5$
5	4	$+5 \leq \Delta T < +15$
4	2	$+15 \leq \Delta T < +25$
1	2	$\Delta T > +25$

[a] This column should be filled out only if Option 1, 2, or 5 was used. *Also, see Attachment 8.*
[b] ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour
    prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13.   The induced leak rate and the test results used to estimate the performance of this system are
        summarized in Attachment 5. Were any tests removed from the data set?
        (X) no
        ( ) yes
        If yes, please specify the reason and include with Attachment 5. (If more than one test was
        removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
    ( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at __38__ psi with __100__ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
9	12.0	0.000	Pass
10	12.0	0.196 at 30 psi	Fail
13	0.3	0.000	Pass

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

Quantity Measured:	Pressure (psi)	Volume (ml)	Time(sec)
Resolution:	0.1	0.5	0.01
Precision:	0.1	0.5	0.05
Accuracy:	0.3	1.0	0.01
Minimum Detectable Quantity:	0.1	1.0	0.01
Response Time:	---	---	---

Threshold is exceeded when the flow rate due to a leak exceeds __0.17__ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

   • the system that was evaluated has not been substantially changed by subsequent modifications

   • the manufacturer's instructions for using the system are followed

   • a mechanical line leak detector
     ( ) is present
     (X) has been removed from the pipeline (Check both if appropriate.)

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is __NA__ h

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is __0.75-1.0__ h

- the total data collection time for the test is __0.53, 0.80__ h *(for pass or fail, respectively)*

- the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

- please give any other limitations specified by the vendor or determined during the evaluation: _____

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated
Attachment 2 - Summary of the Performance of the System Evaluated
Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation
Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation
Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation
Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests
Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise
Attachment 8 - Justification for Abbreviated Test Matrix

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

__William D. Glauz__
(name of person performing evaluation)

__William D. Glauz__ (signature)

__November 13, 1996__
(date)

__(816) 753-7600__
(telephone number)

__Midwest Research Institute__
(organization performing evaluation)

__425 Volker Boulevard__
(street address)

__Kansas City, MO 64110__
(city, state, zip)

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as an
Hourly Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems.* The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: __Veeder-Root Pressurized Line Leak Detector__

Version of System: __Series 8484__

Manufacturer Name: __Veeder-Root__

__125 Powder Forest Drive, Post Office Box 2003__
(street address)

__Simsbury, CT 06070-2003__
(city, state, zip code)

__(203) 651-2700__
(telephone number)

Evaluation Results

1. The performance of this system
    (X) meets or exceeds
    ( ) does not meet
    the federal standards established by the EPA regulation for line tightness tests.

    The EPA regulation for a line tightness test requires that the system be capable of detecting a leak as small as 3.0 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2. The estimated P_{FA} in this evaluation is __0__ % and the estimated P_D against a leak rate of 3.0 gal/h defined at a pipeline pressure of __10__ psi in this evaluation is __100__ %. The system was actually tested at an average calibrated leak rate of __2.67__ gph (at 10 psi) and it detected __100__ % of induced leaks.

Criterion for Declaring a Leak

3.   This system
      (X) uses a preset threshold
      ( ) measures and reports the output quantity and compares it to a predetermined threshold to
      determine whether the pipeline is leaking.

4.   This system
      (X) uses a single test *(1 test after accounting for effects of thermals, if any)*
      ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests
      required) separated by _____ hours (specify the time interval between tests) to determine
      whether the pipeline is leaking.

5.   This system declares a leak if the output of the measurement system exceeds a threshold of
      _1.5_ (specify flow rate in gal/h) in _1_ out of _1_ tests (specify, for example, 1 out
      of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

      _____

      _____

Evaluation Approach

6.   There are five options for collecting the data used in evaluating the performance of this
      system. This system was evaluated
      (X) at a special test facility (Option 1)
      ( ) at one or more instrumented operational tank facilities (Option 2)
      ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
      ( ) at 10 or more operational storage tank facilities (Option 4)
      ( ) with an experimentally validated computer simulation (Option 5).

7.   A total of _53_ tests was conducted on nonleaking pipeline(s) between _5/4/95_ (date) and
      _5/23/95_ (date). A description of the pipeline configuration used in the evaluation is given in
      Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8.   The pipeline used in the evaluation was _1.5_ in. in diameter, _220_ ft long and
      constructed of _other_ (fiberglass, steel or other). *(flexible piping of low bulk modulus)*

9.   A mechanical line leak detector
      ( ) was
      (X) was not   *System has a 3 gal/h test mode, whose function*
      present in the pipeline system.   *replaces that of a mechanical leak detector.*

Answer questions 10 and 11 if Option 3 or 4 was used.

10.   The evaluation was conducted on _____ (how many) pipeline systems ranging in diameter
      from _____ in. to _____ in., ranging in length from _____ ft to _____ ft, and
      constructed of _____ (specify materials).

11. A mechanical line leak detector
     ( ) was
     ( ) was not
     present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the
     data collection:
     ( ) 0 to 6 h
     ( ) 6 to 12 h   *(Not applicable)*
     ( ) 12 to 24 h
     ( ) 24 h or more.

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1.
The difference between the temperature of the product circulated through the pipeline for 1 h or more
and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is
summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product
temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4
was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used[a]	Range of ΔT (°F)[b]
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	12	$-15 \leq \Delta T < -5$
5	11	$-5 \leq \Delta T < +5$
5	10	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > +25$

[a] This column should be filled out only if Option 1, 2, or 5 was used.
[b] ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour
   prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are
     summarized in Attachment 5. Were any tests removed from the data set?
     (X) no
     ( ) yes
     If yes, please specify the reason and include with Attachment 5. (If more than one test was
     removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at __30__ psi with __100__ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
1	-10.0	2.66	Fail
2	-10.0	0.00	Pass
3	-0.3	2.66	Fail

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

Quantity Measured:	Pressure (psi)	Volume (ml)	Time (sec)
Resolution:	0.1	0.5	0.01
Precision:	0.1	0.5	0.05
Accuracy:	0.3	1.0	0.01
Minimum Detectable Quantity:	0.1	1.0	0.01
Response Time:	---	---	----

Threshold is exceeded when the flow rate due to a leak exceeds __1.5__ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications

- the manufacturer's instructions for using the system are followed

- a mechanical line leak detector
( ) is present
(X) has been removed from the pipeline (Check both if appropriate.)

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is ___NA___ h

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is ___0.21___ h

- the total data collection time for the test is _0.07, 0.1_ h *(for pass or fail, respectively)*

- the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

- please give any other limitations specified by the vendor or determined during the evaluation: __SEE SPECIAL ATTACHMENT 8_____

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated
Attachment 2 - Summary of the Performance of the System Evaluated
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Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests
Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

__William D. Glauz_____
(name of person performing evaluation)

__Midwest Research Institute_____
(organization performing evaluation)

_____
(signature)

__425 Volker Boulevard_____
(street address)

__October 6, 1995_____
(date)

__Kansas City, MO 64110_____
(city, state, zip)

__(816) 753-7600_____
(telephone number)

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Line Tightness Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems*. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: __Veeder-Root Pressurized Line Leak Detector__

Version of System: __Series 8484__

Manufacturer Name: __Veeder-Root__

__125 Powder Forest Drive, Post Office Box 2003__
(street address)

__Simsbury, CT 06070-2003__
(city, state, zip code)

__(203) 651-2700__
(telephone number)

Evaluation Results

1. The performance of this system
    (X) meets or exceeds
    ( ) does not meet
    the federal standards established by the EPA regulation for line tightness tests.

    The EPA regulation for a line tightness test requires that the system be capable of detecting a leak as small as 0.1 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2. The estimated P_{FA} in this evaluation is __0__ % and the estimated P_D against a leak rate of 0.1 gal/h defined at a pipeline pressure of __45__ psi (1.5 times the normal operating pressure) in this evaluation is __100__ %. The system was actually tested at an average calibrated leak rate of __0.092__ gph (at 45 psi) and it detected __100__ % of induced leaks.

Criterion for Declaring a Leak

3. This system
   (X) uses a preset threshold
   ( ) measures and reports the output quantity and compares it to a predetermined threshold to determine whether the pipeline is leaking.

4. This system
   (X) uses a single test *(1 test after accounting for effects of thermals, if any)*
   ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests required) separated by _____ hours (specify the time interval between tests) to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of _0.05_ (specify flow rate in gal/h) in _1_ out of _1_ tests (specify, for example, 1 out of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

   _____

   _____

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this system. This system was evaluated
   (X) at a special test facility (Option 1)
   ( ) at one or more instrumented operational tank facilities (Option 2)
   ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
   ( ) at 10 or more operational storage tank facilities (Option 4)
   ( ) with an experimentally validated computer simulation (Option 5).

7. A total of _53_ tests was conducted on nonleaking pipeline(s) between _5/4/95_ (date) and _5/23/95_ (date). A description of the pipeline configuration used in the evaluation is given in Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was _1.5_ in. in diameter, _220_ ft long and constructed of _other_ (fiberglass, steel or other). *(flexible piping of low bulk modulus)*

9. A mechanical line leak detector
   ( ) was
   (X) was not   *System has a 3 gal/h test mode, whose function*
   present in the pipeline system.   *replaces that of a mechanical leak detector.*

Answer questions 10 and 11 if Option 3 or 4 was used.

10. The evaluation was conducted on _____ (how many) pipeline systems ranging in diameter from _____ in. to _____ in., ranging in length from _____ ft to _____ ft, and constructed of _____ (specify materials).

11. A mechanical line leak detector
( ) was
( ) was not
present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection:
( ) 0 to 6 h
( ) 6 to 12 h   *(Not applicable)*
( ) 12 to 24 h
( ) 24 h or more.

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used[a]	Range of ΔT (°F)[b]
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	12	$-15 \leq \Delta T < -5$
5	11	$-5 \leq \Delta T < +5$
5	10	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > +25$

[a] This column should be filled out only if Option 1, 2, or 5 was used.
[b] ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any tests removed from the data set?
(X) no
( ) yes
If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
     ( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at __30__ psi with __100__ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
1	-10.0	0.0910 @ 45 psi	Fail
2	-10.0	0.0	Pass
3	-0.3	0.0	Pass

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

Quantity Measured:	Pressure (psi)	Volume (ml)	Time (sec)
Resolution:	0.1	0.5	0.01
Precision:	0.1	0.5	0.05
Accuracy:	0.3	1.0	0.01
Minimum Detectable Quantity:	0.1	1.0	0.01
Response Time:	---	---	----

Threshold is exceeded when the flow rate due to a leak exceeds __0.05__ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

●   the system that was evaluated has not been substantially changed by subsequent modifications

●   the manufacturer's instructions for using the system are followed

●   a mechanical line leak detector
    ( ) is present
    (X) has been removed from the pipeline (Check both if appropriate.)

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is __NA__ h

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is __1.7__ h

- the total data collection time for the test is __.75, 1.25__ h *(for pass or fail, respectively)*

- the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

- please give any other limitations specified by the vendor or determined during the evaluation: __SEE SPECIAL ATTACHMENT 8__

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated

Attachment 2 - Summary of the Performance of the System Evaluated

Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation

Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation

Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation

Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests

Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

__William D. Glauz__
(name of person performing evaluation)

_____
(signature)

__October 6, 1995__
(date)

__(816) 753-7600__
(telephone number)

__Midwest Research Institute__
(organization performing evaluation)

__425 Volker Boulevard__
(street address)

__Kansas City, MO 64110__
(city, state, zip)

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as an
Hourly Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting an hourly test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems*. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: __TLS Pressurized Line Leak Detector, Series 8484__

Version of System: __----__

Manufacturer Name: __Veeder-Root__

__125 Powder Forest Drive, P.O. Box 2003__
(street address)

__Simsbury, CT 06070-2003__
(city, state, zip code)

__(203) 651-2700__
(telephone number)

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for hourly tests.

   The EPA regulation for an hourly test requires that the system be capable of detecting a leak as small as 3.0 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2. The estimated P_{FA} in this evaluation is __0__% and the estimated P_D against a leak rate of 3.0 gal/h defined at a pipeline pressure of 20 psi in this evaluation is __100%__.

Criterion for Declaring a Leak

3. This system
   (X) uses a preset threshold
   ( ) measures and reports the output quantity and compares it to a predetermined threshold to determine whether the pipeline is leaking.

4. This system
   (X) uses a single test
   ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests required) separated by _____ hours (specify the time interval between tests) to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of 1.88 _gal/hr_ (specify flow rate in gal/h) in __1__ out of __1__ tests (specify, for example, 1 out of 2, 2 out of 3). If more detail is required, please specify in the space provided.

_____

_____

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this system. This system was evaluated

   (X) at a special test facility (Option 1)
   ( ) at one or more instrumented operational storage tank facilities (Option 2)
   ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
   ( ) at 10 or more operational storage tank facilities (Option 4)
   ( ) with an experimentally validated computer simulation (Option 5)

7. A total of ___53___ tests were conducted on nonleaking pipeline ~~tank(s)~~ between _7/8/91_ (date) and _7/20/91_ (date). A description of the pipeline configuration used in the evaluation is summarized in Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was ___2___ in. in diameter, ___219___ ft long and constructed of _fiberglass_ (fiberglass, steel, or other).

9. A mechanical line leak detector
   ( ) was
   (X) was not
   present in the pipeline system.

Answer questions 10 and 11 if Option 3 or 4 was used. NA

10. The evaluation was conducted on _____ (how many) pipeline systems ranging in diameter from _____ in. to _____ in., ranging in length from _____ ft to _____ ft, and constructed of _____ (specify materials).

11. A mechanical line leak detector

    ( ) was   NA

    ( ) was not

    present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection: NA

    ( ) 0 to 6 h

    ( ) 6 to 12 h

    ( ) 12 to 24 h

    ( ) 24 h or more

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2 or 5 was used, a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used*	Range of ΔT (°F)**
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	10	$-15 \leq \Delta T < -5$
5	8	$-5 \leq \Delta T < +5$
5	12	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > 25$

*This column should be filled out only if Option 1, 2, or 5 was used.

**ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any test runs removed from the data set?

    (X) no

    ( ) yes

    If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. (if not excessive.)
( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at __28__ psi with __100__ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
1	+9.99	2.94 gal/hr @ 10 psi	Fail
2	+6.23	2.91 gal/hr @ 10 psi	Fail
3	-6.07	2.8 gal/hr @ 10 psi	Fail

Performance Characteristics of the Instrumentation

16. State below the performance characteristics of the primary measurement system used to collect the data. (Please specify the units, for example, gallons, inches.)

Quantity Measured:	Pressure (psi)	Volume (ml)	Time (sec)
Resolution:	0.1	0.5	0.01
Precision:	0.1	0.5	0.05
Accuracy:	0.3	1.0	0.01
Minimum Detectable Quantity:	0.1	1.0	0.01
Response Time:	---	---	---

Threshold is exceeded when the flow rate due to a leak exceeds __1.88__ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities, that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 150 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications

- the manufacturer's instructions for using the system are followed

- the mechanical line leak detector
  ( ) is present in
  (X) has been removed from
  the pipeline (check both if appropriate)
  A mechanical line leak detector is no longer needed because the CEI system performs a 3.0 gph test every time dispensing stops.

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is ___NA___ h
- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is ___.27___ h
- the total data collection time for the test is ___.008___ h

- the volume of the product in the pipeline is less than twice the volume of the product in the pipeline system used in the evaluation, unless separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8

- please give any other limitations specified by the vendor or determined during the evaluation: _____

_____

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated

Attachment 2 - Summary of the Performance of the System Evaluated

Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation

Attachment 4 - Data Sheet Summarizing Product Temperature Conditions Used in the Evaluation

Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation

Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests

Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining the Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

William D. Glauz	Midwest Research Institute
(name of person performing evaluation)	(organization performing evaluation)
(signature)	425 Volker Boulevard
	(street address)
8/07/91	Kansas City, MO 64110
(date)	(city, state, zip)
(816) 753-7600	
(telephone number)	

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Line Tightness Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems*. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: _____ **TLS Pressurized Line Leak Detector, Series 8484**

Version of System: _____ **----**

Manufacturer Name: _____ **Veeder-Root**

_____ **125 Powder Forest Drive, P.O. Box 2003** _____

(street address)

Simsbury, CT 06070-2003

(city, state, zip code)

(203) 651-2700

(telephone number)

_____

_____

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for a line tightness test requires that the system be capable of detecting a leak as small as 0.1 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2. The estimated P_{FA} in this evaluation is __0__% and the estimated P_D against a leak rate of 0.1 gal/h defined at a pipeline pressure of 20 psi in this evaluation is __100__%.

Criterion for Declaring a Leak

3. This system
   (x) uses a preset threshold
   ( ) measures and reports the output quantity and compares it to
       a predetermined threshold
   to determine whether the pipeline is leaking.

4. This system
   (x) uses a single test
   ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests
       required) separated by _____ hours (specify the time interval between tests)
   to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of
   __0.05__ (specify flow rate in gal/h) in __1__ out of __1__ tests (specify, for example, 1
   out of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.
   __After accounting for effects of thermals, if any.__

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this
   system. This system was evaluated

   (x) at a special test facility (Option 1)
   ( ) at one or more instrumented operational storage tank facilities (Option 2)
   ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
   ( ) at 10 or more operational storage tank facilities (Option 4)
   ( ) with an experimentally validated computer simulation (Option 5)
                                                          pipeline
7. A total of __53__ tests were conducted on nonleaking tanks) between __7/8/91__ (date)
   and __7/20/91__ (date). A description of the pipeline configuration used in the evaluation is
   given in Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was __2__ in. in diameter, __219__ ft long and
   constructed of __fiberglass__ (fiberglass, steel, or other).

9. A mechanical line leak detector
   ( ) was   System has a 3 gph test mode, whose function
   (x) was not   replaces that of a mechanical leak detector.
   present in the pipeline system.

Answer questions 10 and 11 if Option 3 or 4 was used.   NA

10. The evaluation was conducted on _____ (how many) pipeline systems ranging in
    diameter from _____ in. to _____ in., ranging in length from _____ ft to
    _____ ft, and constructed of _____ (specify materials).

11. A mechanical line leak detector
   ( ) was
   ( ) was not   NA
   present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection:
   ( ) 0 to 6 h   NA
   ( ) 6 to 12 h
   ( ) 12 to 24 h
   ( ) 24 h or more

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2 or 5 was used a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used*	Range of ΔT (°F)**
1	2	$\Delta T < -25$
4	8	$-25 \le \Delta T < -15$
5	11	$-15 \le \Delta T < -5$
5	8	$-5 \le \Delta T < +5$
5	14	$+5 \le \Delta T < +15$
4	8	$+15 \le \Delta T < +25$
1	2	$\Delta T > 25$

*This column should be filled out only if Option 1, 2, or 5 was used.

**ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any test runs removed from the data set?
   (X) no
   ( ) yes

   If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14. (x) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. (If not excessive)
( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at ___*___ psi with _100_ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

* (approximately 1.5 times operating pressure)

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
1	+8.56	0.0 gal/hr	PASS
2	+6.23	0.097 gph @ 40 psi	FAIL
3	-10.18	0.099 gph @ 40 psi	FAIL

Performance Characteristics of the Instrumentation

16. State below the performance characteristics of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

Quantity Measured:	Pressure (psi)	Volume (ml)	Time (sec)
Resolution:	0.1	0.5	0.01
Precision:	0.1	0.5	0.05
Accuracy:	0.3	1.0	0.01
Minimum Detectable Quantity:	0.1	1.0	0.01
Response Time:	--	--	--

Threshold is exceeded when the flow rate due to a leak exceeds __0.05__ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities, that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications
- the manufacturer's instructions for using the system are followed
- a mechanical line leak detector
  ( ) is present in
  (x) has been removed from
  the pipeline (check both if appropriate)

  { System has a 3 gph test mode, whose function replaces that of a mechanical line leak detector.

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is ___NA___ h
- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is ___2.5___ h
- the total data collection time for the test is ___0.3___ h

- the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8
- please give any other limitations specified by the vendor or determined during the evaluation: _____

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated

Attachment 2 - Summary of the Performance of the System Evaluated

Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation

Attachment 4 - Data Sheet Summarizing Product Temperature Conditions Used in the Evaluation
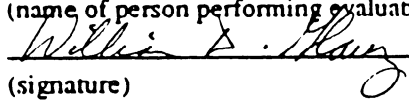
Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation

Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests

Attachment 7 -- Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining the Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

William D. Glauz
_____
(name of person performing evaluation)

(signature)

__August 7, 1991__
(date)
(816) 753-7600
(telephone number)

Midwest Resarch Institute
_____
(organization performing evaluation)
425 Volker Boulevard
_____
(street address)
Kansas City, MO 64110
_____
(city, state, zip)

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as an
Hourly Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems*. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name:__Veeder-Root Pressurized Line Leak Detector_____

Version of System:__Series 8494 Line Leak Detector for TLS-350/350R and LLD-300___

Manufacturer Name:__Veeder-Root_____

125 Powder Forest Drive, Post Office Box 2003_____
(street address)

Simsbury, CT 06070-2003_____
(city, state, zip code)

(203) 651-2700_____
(telephone number)

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for an hourly line tightness test requires that the system be capable of detecting a leak as small as 3.0 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2. The estimated P_{FA} in this evaluation is __0__ % and the estimated P_D against a leak rate of 3.0 gal/h defined at a pipeline pressure of __10__ psi in this evaluation is __100__ %. The system was actually tested at an average calibrated leak rate of 2.962 gph (at 10 psi) and it detected __100__ % of induced leaks.

Criterion for Declaring a Leak

3.　This system
(X) uses a preset threshold
( ) measures and reports the output quantity and compares it to a predetermined threshold to determine whether the pipeline is leaking.

4.　This system
(X) uses a single test
( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests required) separated by _____ hours (specify the time interval between tests) to determine whether the pipeline is leaking.

5.　This system declares a leak if the output of the measurement system exceeds a threshold of _2.5_ (specify flow rate in gal/h) in _1_ out of _1_ tests (specify, for example, 1 out of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

_____

_____

Evaluation Approach

6.　There are five options for collecting the data used in evaluating the performance of this system. This system was evaluated
(X) at a special test facility (Option 1)
( ) at one or more instrumented operational tank facilities (Option 2)
( ) at five or more operational storage tank facilities verified to be tight (Option 3)
( ) at 10 or more operational storage tank facilities (Option 4)
( ) with an experimentally validated computer simulation (Option 5).

7.　A total of _57_ tests was conducted on nonleaking pipeline(s) between _3/6/96_ (date) and _3/14/96_ (date). A description of the pipeline configuration used in the evaluation is given in Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8.　The pipeline used in the evaluation was _2.22_ in. in diameter, _250_ ft long and constructed of _fiberglass_ (fiberglass, steel or other).

9.　A mechanical line leak detector
( ) was
(X) was not　　　　　　　　　　*System's 3 gal/h test mode, being tested, is a function*
present in the pipeline system.　*that replaces that of a mechanical leak detector.*

Answer questions 10 and 11 if Option 3 or 4 was used.

10.　The evaluation was conducted on _____ (how many) pipeline systems ranging in diameter from _____ in. to _____ in., ranging in length from _____ ft to _____ ft, and constructed of _____ (specify materials).

11.   A mechanical line leak detector
       ( ) was
       ( ) was not
       present in the majority of the pipeline systems used in the evaluation.

12.   Please specify how much time elapsed between the delivery of product and the start of the
       data collection:
       ( ) 0 to 6 h
       ( ) 6 to 12 h   *(Not applicable)*
       ( ) 12 to 24 h
       ( ) 24 h or more.

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1.
The difference between the temperature of the product circulated through the pipeline for 1 h or more
and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is
summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product
temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4
was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used[a]	Range of ΔT (°F)[b]
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	10	$-15 \leq \Delta T < -5$
5	10	$-5 \leq \Delta T < +5$
5	12	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > +25$

[a] This column should be filled out only if Option 1, 2, or 5 was used.
[b] ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour
    prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13.   The induced leak rate and the test results used to estimate the performance of this system are
       summarized in Attachment 5. Were any tests removed from the data set?
       (X) no
       ( ) yes
       If yes, please specify the reason and include with Attachment 5. (If more than one test was
       removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14.   (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15.   The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at __20-25__ psi with __100__ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6. Two additional tests were performed with a large amount of vapor accidently placed in the line. Although the system performed correctly, the results are not included in these forms as they were not in accordance with the test protocol.

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
35	-10.6	0.00	Pass
36	-10.6	0.00	Pass
53	0.0	2.950	Fail

Performance Characteristics of the Instrumentation

16.   State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

Quantity Measured:	Pressure (psi)	Volume (ml)	Time (sec)
Resolution:	0.1	0.5	0.01
Precision:	0.1	0.5	0.05
Accuracy:	0.3	1.0	0.01
Minimum Detectable Quantity:	0.1	1.0	0.01
Response Time:	---	---	----

Threshold is exceeded when the flow rate due to a leak exceeds __2.5__ gal/h.

Application of the System

17.   This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

●   the system that was evaluated has not been substantially changed by subsequent modifications

●   the manufacturer's instructions for using the system are followed

●   a mechanical line leak detector
( ) is present
(X) has been removed from the pipeline (Check both if appropriate.)

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is __NA__ h

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is __0.0__ h

- the total data collection time for the test is _0.033_ h

- the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

- please give any other limitations specified by the vendor or determined during the evaluation: _____

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated

Attachment 2 - Summary of the Performance of the System Evaluated

Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation

Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation

Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation

Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests

Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

__William D. Glauz__
(name of person performing evaluation)

(signature)

__May 8, 1996__
(date)

__(816) 753-7600__
(telephone number)

__Midwest Research Institute__
(organization performing evaluation)

__425 Volker Boulevard__
(street address)

__Kansas City, MO 64110__
(city, state, zip)

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Monthly Monitoring Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a monthly monitoring test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems.* The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: __Veeder-Root Pressurized Line Leak Detector__

Version of System: __Series 8494 Line Leak Detector for TLS-350/350R and LLD-300__

Manufacturer Name: __Veeder-Root__

__125 Powder Forest Drive, Post Office Box 2003__
(street address)

__Simsbury, CT 06070-2003__
(city, state, zip code)

__(203) 651-2700__
(telephone number)

Evaluation Results

1. The performance of this system
    (X) meets or exceeds
    ( ) does not meet
    the federal standards established by the EPA regulation for line tightness tests.

    The EPA regulation for a monthly monitoring test requires that the system be capable of detecting a leak as small as 0.2 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2. The estimated P_{FA} in this evaluation is __0__ % and the estimated P_D against a leak rate of 0.2 gal/h defined at a pipeline pressure of __31__ psi (the normal operating pressure) in this evaluation is __100__ %. The system was actually tested at an average calibrated leak rate of __0.195__ gph (at 31 psi) and it detected __100__ % of induced leaks.

Criterion for Declaring a Leak

3.   This system
        (X) uses a preset threshold
        ( ) measures and reports the output quantity and compares it to a predetermined threshold to
        determine whether the pipeline is leaking.

4.   This system
        (X) uses a single test *(1 test after accounting for effects of thermals, if any)*
        ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests
        required) separated by _____ hours (specify the time interval between tests) to determine
        whether the pipeline is leaking.

5.   This system declares a leak if the output of the measurement system exceeds a threshold of
        _0.17_ (specify flow rate in gal/h) in _1_ out of _1_ tests (specify, for example, 1 out
        of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

        _____
        _____

Evaluation Approach

6.   There are five options for collecting the data used in evaluating the performance of this
        system. This system was evaluated
        (X) at a special test facility (Option 1)
        ( ) at one or more instrumented operational tank facilities (Option 2)
        ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
        ( ) at 10 or more operational storage tank facilities (Option 4)
        ( ) with an experimentally validated computer simulation (Option 5).

7.   A total of _53_ tests was conducted on nonleaking pipeline(s) between _3/6/96_ (date) and
        _3/14/96_ (date). A description of the pipeline configuration used in the evaluation is given in
        Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8.   The pipeline used in the evaluation was _2.22_ in. in diameter, _250_ ft long and
        constructed of _fiberglass_ (fiberglass, steel or other).

9.   A mechanical line leak detector
        ( ) was
        (X) was not   *System has a 3 gal/h test mode, whose function*
        present in the pipeline system.   *replaces that of a mechanical leak detector.*

Answer questions 10 and 11 if Option 3 or 4 was used.

10.   The evaluation was conducted on _____ (how many) pipeline systems ranging in diameter
        from _____ in. to _____ in., ranging in length from _____ ft to _____ ft, and
        constructed of _____ (specify materials).

11. A mechanical line leak detector
( ) was
( ) was not
present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection:
( ) 0 to 6 h
( ) 6 to 12 h   *(Not applicable)*
( ) 12 to 24 h
( ) 24 h or more.

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used[a]	Range of ΔT (°F)[b]
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	10	$-15 \leq \Delta T < -5$
5	10	$-5 \leq \Delta T < +5$
5	10	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > +25$

[a] This column should be filled out only if Option 1, 2, or 5 was used.
[b] ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any tests removed from the data set?
(X) no
( ) yes
If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at __31__ psi with __100__ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
35	-10.6	0.194 @ 31 psi	Fail
36	-10.6	0.0	Pass
53	0.0	0.0	Pass

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

	Pressure (psi)	Volume (ml)	Time (sec)
Quantity Measured:			
Resolution:	0.1	0.5	0.01
Precision:	0.1	0.5	0.05
Accuracy:	0.3	1.0	0.01
Minimum Detectable Quantity:	0.1	1.0	0.01
Response Time:	---	---	----

Threshold is exceeded when the flow rate due to a leak exceeds __0.17__ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications

- the manufacturer's instructions for using the system are followed

- a mechanical line leak detector
( ) is present
(X) has been removed from the pipeline (Check both if appropriate.)

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is __NA__ h

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is __0.75__ h

- the total data collection time for the test is __0.50, 0.75__ h *(for pass or fail, respectively)*

- the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

- please give any other limitations specified by the vendor or determined during the evaluation: _____

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated

Attachment 2 - Summary of the Performance of the System Evaluated

Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation

Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation

Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation

Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests
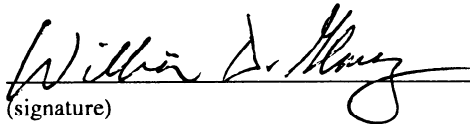
Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

__William D. Glauz__
(name of person performing evaluation)

__Midwest Research Institute__
(organization performing evaluation)

(signature)

__425 Volker Boulevard__
(street address)

__May 8, 1996__
(date)

__Kansas City, MO 64110__
(city, state, zip)

__(816) 753-7600__
(telephone number)

Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Line Tightness Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a monthly monitoring test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in *Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems*. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: __Veeder-Root Pressurized Line Leak Detector__

Version of System: __Series 8494 Line Leak Detector for TLS-350/350R and LLD-300__

Manufacturer Name: __Veeder-Root__

__125 Powder Forest Drive, Post Office Box 2003__
(street address)

__Simsbury, CT 06070-2003__
(city, state, zip code)

__(203) 651-2700__
(telephone number)

Evaluation Results

1.   The performance of this system
     (X) meets or exceeds
     ( ) does not meet
     the federal standards established by the EPA regulation for line tightness tests.

     The EPA regulation for a line tightness test requires that the system be capable of detecting a leak as small as 0.1 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_{FA}) of 5%.

2.   The estimated P_{FA} in this evaluation is __0__ % and the estimated P_D against a leak rate of 0.1 gal/h defined at a pipeline pressure of __45__ psi (1.5 times the normal operating pressure) in this evaluation is __100__ %. The system was actually tested at an average calibrated leak rate of __0.096__ gph (at 45 psi) and it detected __100__ % of the induced leaks.

Criterion for Declaring a Leak

3. This system
    (X) uses a preset threshold
    ( ) measures and reports the output quantity and compares it to a predetermined threshold to
    determine whether the pipeline is leaking.

4. This system
    (X) uses a single test *(1 test after accounting for effects of thermals, if any)*
    ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests
    required) separated by _____ hours (specify the time interval between tests) to determine
    whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of
    _0.09_ (specify flow rate in gal/h) in _1_ out of _1_ tests (specify, for example, 1 out
    of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

    _____

    _____

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this
    system. This system was evaluated
    (X) at a special test facility (Option 1)
    ( ) at one or more instrumented operational tank facilities (Option 2)
    ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
    ( ) at 10 or more operational storage tank facilities (Option 4)
    ( ) with an experimentally validated computer simulation (Option 5).

7. A total of _53_ tests was conducted on nonleaking pipeline(s) between _6/25/96_ (date) and
    _7/5/96_ (date). A description of the pipeline configuration used in the evaluation is given in
    Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was _2.22_ in. in diameter, _249_ ft long and
    constructed of _fiberglass_ (fiberglass, steel or other).

9. A mechanical line leak detector
    ( ) was
    (X) was not   *System has a 3 gal/h test mode, whose function*
    present in the pipeline system.   *replaces that of a mechanical leak detector.*

Answer questions 10 and 11 if Option 3 or 4 was used.

10. The evaluation was conducted on _____ (how many) pipeline systems ranging in diameter
    from _____ in. to _____ in., ranging in length from _____ ft to _____ ft, and
    constructed of _____ (specify materials).

11. A mechanical line leak detector
     ( ) was
     ( ) was not
     present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the
     data collection:
     ( ) 0 to 6 h
     ( ) 6 to 12 h   *(Not applicable)*
     ( ) 12 to 24 h
     ( ) 24 h or more.

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1.
The difference between the temperature of the product circulated through the pipeline for 1 h or more
and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is
summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product
temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4
was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

Minimum Number of Conditions Required	Number of Conditions Used[a]	Range of ΔT (°F)[b]
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	10	$-15 \leq \Delta T < -5$
5	10	$-5 \leq \Delta T < +5$
5	10	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > +25$

[a] This column should be filled out only if Option 1, 2, or 5 was used.
[b] ΔT is the difference between the temperature of the product dispensed through the pipeline for over an hour
   prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are
     summarized in Attachment 5. Were any tests removed from the data set?
     (X) no
     ( ) yes
     If yes, please specify the reason and include with Attachment 5. (If more than one test was
     removed, specify each reason separately.)

Sensitivity to Trapped Vapor

14.   (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
        ( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15.   The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at __38__ psi with __100__ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)
35	-11.9	0.095 at 45 psi	Fail
36	-11.9	0.0	Pass
53	-0.7	0.095 at 45 psi	Fail

Performance Characteristics of the Instrumentation

16.   State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

        Quantity Measured: _____Pressure (psi)_____Volume (ml)_____Time (sec)__
        Resolution: _____0.1_____0.5_____0.01__
        Precision: _____0.1_____0.5_____0.05__
        Accuracy: _____0.3_____1.0_____0.01__
        Minimum Detectable Quantity: _____0.1_____1.0_____0.01__
        Response Time: _____---_____---_____----__
        Threshold is exceeded when the flow rate due to a leak exceeds __0.09__ gal/h.

Application of the System

17.   This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

        • the system that was evaluated has not been substantially changed by subsequent modifications

        • the manufacturer's instructions for using the system are followed

        • a mechanical line leak detector
          ( ) is present
          (X) has been removed from the pipeline (Check both if appropriate.)

- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is __NA__ h

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is __2.0__ h

- the total data collection time for the test is __0.53, 0.80__ h *(for pass or fail, respectively)*

- the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

- please give any other limitations specified by the vendor or determined during the evaluation: _____

Disclaimer: *This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.*

Attachments

Attachment 1 - Description of the System Evaluated

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Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests

Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

__William D. Glauz__
(name of person performing evaluation)

[signature]
(signature)

__September 13, 1996__
(date)

__(816) 753-7600__
(telephone number)

__Midwest Research Institute__
(organization performing evaluation)

__425 Volker Boulevard__
(street address)

(city, state, zip)

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