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Requirements for Diluting and Flushing Double-Shell Tank Systems

D. P. Fassett
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U.S. Department of Energy Contract DE-AC06-99RL-14047

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This document identifies requirements and their applicability to the design and operation of the Double-Shell Tank Diluent and Flush Subsystem. The requirements are described here to justify their use in the *Double-Shell Tank Diluent and Flush Subsystem Specification* (HNF-4163).

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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

CH2MHILL
Hanford Group, Inc.

Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC06-99RL14047

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TERMS

DCRT	double-contained receiver tank
DFS	Double-Shell Tank Diluent and Flush Subsystem
DST	double-shell tank
HTWOS	Hanford Tank Waste Operations Simulator
$NaNO_2$	sodium nitrite
NaOH	sodium hydroxide
SST	single-shell tank

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REQUIREMENTS FOR DILUTING AND FLUSHING DOUBLE-SHELL TANK SYSTEMS

1.0 INTRODUCTION

This document identifies requirements and their applicability to the design and operation of the Double-Shell Tank Diluent and Flush Subsystem (DFS). The requirements are described here to justify their use in *Double-Shell Tank Diluent and Flush Subsystem Specification,* HNF-4163. The applications and demands on the DFS primarily were determined from the case 3 waste retrieval scenario presented in the *Tank Waste Remediation System Operation and Utilization Plan To Support Waste Feed Delivery*, HNF-SD-WM-SP-012. The case 3 scenario was developed from the Hanford Tank Waste Operations Simulator (HTWOS) computer model and it represented the best plans for tank waste retrieval operations at the time it was completed. The potential DST waste retrieval applications for the DFS double-shell tanks were investigated, and the associated requirements for each application were evaluated.

The DFS must provide treated or heated water for the following applications:

- Waste transfer-line preheating
- Transfer startup and in-line dilution
- In-tank dilution
- Transfer-pump and waste transfer-line flush
- Tank-heel flush
- Single-shell tank (SST) retrieval with high-pressure liquid to mobilize solids.

The requirements of the DFS are presented in Table 1.

Table 1. Component Requirements. (2 sheets)

Component Specification Section*	Component Requirement	Reference
3.2.1.1.b	The Double-Shell Tank Diluent and Flush Subsystem (DFS) shall have the capability to provide heated water or solution at a temperature that is at least as high as the waste to be transferred.	This document; HNF-1939, Vol. II
3.2.1.1.c	The DFS shall have the capability to provide solutions to be used for waste transfer line preheating, in-line dilution, in-tank dilution, and tank-heel flushing at temperatures as high as 60 °C (140 °F). <TBR>	This document; HNF-1939, Vol. II
3.2.1.1.d	The DFS shall have the capability to provide solutions to be used for in-line dilution at flow rates as high as 50% of the waste flow rates for periods up to 5 days. <TBR>	This document; HNF-1939, Vol. II
3.2.1.1.f	The DFS shall be capable of adjusting the composition of sodium hydroxide from 0.010 M to <TBD> M and the composition of sodium nitrite from 0.011 M to <TBD> M to prepare needed diluent solutions.	This document
3.2.1.1.h	The DFS shall be capable of adjusting the flow rate of diluent during in-line dilutions to compensate for changes in the specific gravity of waste.	Internal Memorandum 73600-99-006
3.2.1.2.b	The DFS shall be capable of preparing and providing flush solutions with compositions that are at least 0.01 M hydroxide and at least 0.011 M nitrite.	This document; Internal Memorandum 7F540-94-019; Internal Memorandum 71420-95-002; HNF-1939, Vol. II
3.2.1.2.c	The DFS shall be capable of flushing each waste transfer line with a volume of solution that is twice the volume of the transfer line.	This document; HNF-1939, Vol. II; BNFL-5193-ID-19; BNFL-5193-ID-20
3.2.1.2.d	The DFS shall be capable of providing a flow of 0.606 m^3/min (160 gal/min) at a pressure of 4,480 kPa (650 lbf/in^2) to the DST Transfer Valving Subsystem for flushing waste transfer lines.	This document; RPP-5346; HNF-1939, Vol. II
3.3.1.m	The DFS shall be capable of transitioning from providing a flush solution to providing a diluent solution within 24 hours and from providing a diluent solution to providing a flush solution without delay.	This document
3.3.1.o	The DFS shall be controllable by the DST Monitor and Control Subsystem. Chemical adjustments to flush and diluent solutions, temperature adjustments of the solutions, flow rate adjustments of the solutions, and the shutdown of the subsystem shall be possible from the DST Monitor and Control Subsystem.	This document; HNF-4155
3.2.1.3.b	The DFS shall measure the quantity of heated water or solution provided to the transfer-associated structure.	This document
3.3.1.p	The DFS shall be capable of adjusting the flow rate of water or solution to support transitions from the line preheating application to the in-line dilution application.	This document

Table 1. Component Requirements. (2 sheets)

Component Specification Section*	Component Requirement	Reference
3.3.1.q	The DFS shall be capable of adjusting the flow rate and chemical composition of solutions to support transitions from the in-line dilution application to the waste transfer line flush application.	This document
3.1.2.1.5.a	The DFS shall be capable of using concentrated commercial-grade sodium hydroxide (commonly referred to as caustic soda) at a concentration of up to 50 wt.% provided by the DST Maintenance and Recovery Subsystem.	This document
3.1.2.1.5.b	The DFS shall be capable of using concentrated commercial-grade 40 wt% sodium nitrite ($NaNO_2$) provided by the DST Maintenance and Recovery Subsystem.	This document

*Section in HNF-4163 where requirement is discussed.

BNFL-5193-ID-19, 1998, Interface Control Document Between DOE and BNFL Inc. for Low-Activity Waste Feed, Rev. 3, BNFL Inc., Richland, Washington.

BNFL-5193-ID-20, 1998, Interface Control Document Between DOE and BNFL Inc. for High-Level Waste Feed, Rev. 3, BNFL Inc., Richland, Washington.

HNF-1939, 1999, Waste Feed Delivery Technical Basis, Vol. II, "Waste Feed Delivery Flowsheet," Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-4155, 2000, Double-Shell Tank Monitor and Control Subsystem Specification, Rev. 0, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-4163, 2000, Double-Shell Tank Diluent and Flush Subsystem Specification, Rev. 0, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

Internal Memorandum 73600-99-006, 1999, "Interim Guidance on LAW Retrieval Strategy," June 22, 1999, by R. L. Treat, MACTEC, for Numatec Hanford Corporation, Richland, Washington.

Internal Memorandum 71420-95-002, 1995, "Use of Inhibited Water for Cross-Site Transfer of Tank 241-SY-102 Waste," January 10, 1995, by R. P. Anantatmula, Westinghouse Hanford Company, Richland, Washington.

Internal Memorandum 7F540-94-019, 1994, "Projects W-058/W-028 Material of Construction Position Paper," June 10, 1994, by G. L. Parsons, Westinghouse Hanford Company, Richland, Washington.

RPP-5346, 2000, Waste Feed Delivery Transfer System Analysis, Rev. 0, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

DFS = Double-Shell Tank Diluent and Flush Subsystem.
DST = Double-Shell Tank.

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2.0 APPLICATIONS OF AND DEMANDS ON THE DOUBLE-SHELL TANK DILUENT AND FLUSH SUBSYSTEM

2.1 APPLICATIONS OF THE DOUBLE-SHELL TANK DILUENT AND FLUSH SUBSYSTEM

A wide range of potential applications was evaluated to identify requirements for the DFS. Table 2 identifies these applications and summarizes the requirements. The table is intended to be used as a screening tool and to give an indication of the confidence in existing documentation for the listed requirements. In general, it was determined that all applications requiring treated or heated water should be supplied by the DFS. Applications 1 through 6, in Table 2, represent the greatest expected demands on the DFS, and the DFS requirements were based on these applications. However, it should be possible for the DFS to support applications other than 1 through 6. This document clarifies and describes requirements for applications 1 through 6 that are not documented or adequately described elsewhere. Applications 7 through 14 have been evaluated, and it was determined that their demands on the DFS are sufficiently small as to not require further analysis.

Table 2. Potential Applications and Requirements. (2 sheets)

Application	Need for Chemical Adjustment	Need for Heated Solution	Need for Filtered Solution	Quantity of Solution
1. Waste transfer-line preheating	Not necessary	Necessary	Not necessary	About twice the volume of transfer lines
2. In-line dilution	Possible but not documented	Match waste temperature	Not necessary	More than 1,000 m^3 (260,000 gal.)
3. Transfer-pump and waste transfer-line flushing	Treated* water	Not documented, but a study is planned to verify if heated solution is needed	Not necessary	Range is uncertain – 114.0 m^3 (30,000 gal) now used for cross-site line
4. In-tank dilution	Required to mitigate corrosion effects	Match waste temperature or meet waste temperature change requirements	Not necessary	More than 1,000 m^3 (260,000 gal)
5. Tank-heel flushing	Required to mitigate corrosion effects	Match waste temperature or meet waste temperature change requirements	Not necessary	About 530 m^3 per flush (140,000 gal)
6. Single-shell tank retrieval	Required to mitigate corrosion effects	Not yet evaluated	Not necessary	More than 1,000 m^3 (260,000 gal)
7. Mixer-pump cavity flush	Not necessary	Recommended to enhance material dissolution	Not necessary	Probably about 1 m^3 (260 gal)

Table 2. Potential Applications and Requirements. (2 sheets)

Application	Need for Chemical Adjustment	Need for Heated Solution	Need for Filtered Solution	Quantity of Solution
8. Mixer-pump and transfer-pump seals	Not necessary	Not necessary	≤5 μm filtration (HNF-4164)	Up to 0.5 m^3 per 5 days (130 gal per 5 days)
9. Boreholes for mixer-pump installations	Required to mitigate corrosion effects	Recommended for material dissolution	Not necessary	Possibly up to 38 m^3 (10,000 gal)
10. Mixer pump column water	Not necessary	Not necessary	≤75 μm filtration (HNF-4164)	Uncertain
11. Wash tank interiors	Required to mitigate corrosion effects	Recommended for dissolution	Not necessary	Uncertain
12. Flush air-lift circulators	Not necessary	Recommended for dissolution	Not necessary	About 3.8 m^3/month (1,000 gal)
13. Tank make-up water	Required to mitigate corrosion effects	Not necessary	Not necessary	About 3.8 m^3/month (1,000 gal)
14. Pump wash water	Not necessary	Recommended for dissolution	Not necessary	Uncertain

*Treated water is defined as water with 0.010 M hydroxide and 0.011 M nitrite.

HNF-4164, 2000, Double-Shell Tank Mixer Pump Subsystem Specification, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

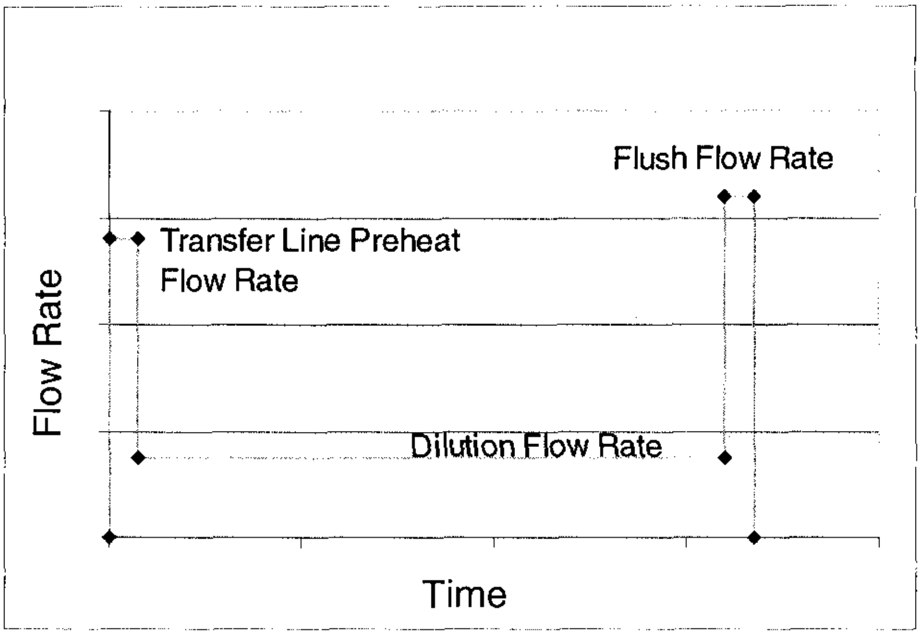
The number of occurrences of different applications and the timing of the applications were investigated to determine the demands on the DFS. The applications that were investigated included the following:

- Waste transfer-line preheating
- In-line dilution
- Transfer pump and waste transfer-line flushing
- In-tank dilution
- Tank-heel flushing
- SST retrieval.

The case 3 scenario projects several hundred waste transfer-line flushes, several hundred waste transfer-line preheating applications, and two dozen or less of each of the remaining scenarios. These six scenarios are discussed in further detail in Sections 2.2.1 through 2.2.6.

Figure 1 shows the transfer startup and in-line dilution process and the duration of each step for a typical waste transfer. A detailed description of this transfer is available in HNF-1939, *Waste Feed Delivery Technical Basis*, Vol. II, "Waste Feed Delivery Flowsheet." The waste transfer-line preheat and waste transfer-line flush steps are linked to the in-line dilution step because the DFS must transition from performing a transfer-line preheat function to performing an in-line dilution function and thereafter must provide a flush function.

Figure 1. Typical Process Flows for DFS Liquids to Support a Waste Transfer with In-Line Dilution.



2.2 DEMANDS ON THE DOUBLE-SHELL TANK DILUENT AND FLUSH SUBSYSTEM

2.2.1 Waste Transfer-Line Preheating

2.2.1.1 Non-Aging Waste. The DFS must be capable of preheating waste transfer lines to reduce the possibility of waste constituents precipitating during the transfer of non-aging waste. Cold transfer lines will cool the waste during transfer, and this cooling may cause the dissolved constituents to precipitate and possibly plug the transfer line. This is a concern for non-aging waste, because it generally contains a much higher concentration of dissolved constituents than aging waste. There is no administrative limit on the concentrations of dissolved constituents in non-aging waste. Preheating may be done by using the DFS to provide heated liquid to the DST waste transfer pump before the waste transfer or by using the DFS supply pump to move heated liquid through the waste transfer line.

There is documentation on the need to preheat waste transfer lines and on the minimum temperature of liquid that should be used to preheat the lines. Documentation on the need to preheat waste transfer lines is found in HNF-1939, Vol. II, Rev. 0b. In addition, HNF-1939, Vol. II, Rev. 0b, Addendum 2-31, indicates that the temperature of the preheat liquid should be at least as warm as the waste to be transferred. However, the quantity of liquid required to adequately preheat waste transfer lines depends on the acceptable temperature drop for waste to be transferred. The smaller the acceptable temperature drop for waste to be transferred, the larger the quantity of preheated liquid that would be required. Alternatively, the temperature of preheat water could be increased as the acceptable temperature drop for waste decreases. To further complicate this issue, the temperature and/or quantity of preheat liquid required depends on the length of the waste transfer line to be preheated, the velocity of preheat liquid, and other variables. Because of the uncertainty of the acceptable temperature drop for waste to be transferred and the uncertainties associated with waste transfer operations, no requirement could be identified for the DFS to provide a specific quantity of preheat liquid or for the DFS to provide preheat liquid at a specific temperature. The requirement for preheat liquid will state only that the DFS must provide preheat liquid that is at least as warm as the waste to be transferred.

It is not necessary to treat the water used to preheat waste transfer lines if the residence time of the preheated water is very short. It is expected that the residence time will almost always be a matter of minutes before a follow-up waste transfer is made. Therefore, treatment of the preheated water should not be necessary.

2.2.1.2 Aging Waste. There is no requirement to preheat the waste transfer lines for aging waste, because precipitation of this waste is not expected to be a problem. There is an operating specification limit on the concentration of dissolved sodium that may be present in aging waste. The concentration of sodium cannot exceed 5.5 M in Tank 241-AZ-101 and cannot exceed 5.0 M in the other AZ and AY tanks according to OSD-T-151-00017, *Operating Specifications for Aging-Waste Operations in 241-AY and 241-AZ*, Rev. D-12. Additionally, the temperatures of wastes in aging waste tanks are higher than the temperatures of wastes in non-aging waste DSTs, which further reduces the possibility of precipitation. Therefore, precipitation caused by waste cooling is not considered to be a problem for transfers of aging waste.

2.2.2 In-Line Dilution

In-line dilution applications for the DFS were identified from the case 3 scenario. In-line dilutions are required for waste that has a high concentration of dissolved constituents before the waste is transferred to a new tank. The in-line dilutions reduce the possibility of plugging waste transfer lines and avoid the need for waste transfer evaluations. The DFS must be available and must operate reliably during the 1-to-5-day periods when these dilutions are required. An unavailable subsystem could adversely impact waste transfer schedules, and an unreliable subsystem that may fail during an operation would increase the possibility of waste transfer-line plugging. It may be necessary to adjust the percentage of diluent during a waste transfer if the solids content of the transferred waste changes. This requirement is documented in Internal Memorandum 73600-99-006, "Interim Guidance on LAW Retrieval Strategy." Insufficient space prevents diluting DST waste in situ.

The DFS must be capable of providing diluent for in-line dilution from no flow rate, through a range of flow rates, and up to a maximum flow rate. The maximum flow rate for diluent for in--line dilution depends on the concentration of dissolved salts in the waste to be transferred. DST wastes that are diluted sufficiently to achieve a specific gravity of less than 1.35 and a solids content of less than 5 percent are not expected to pose a risk to transfer lines. Wastes that do not meet these criteria must be evaluated before they are transferred to ensure that the risk of line plugging is acceptable (HNF-SD-WM-OCD-15, *Tank Farm Waste Transfer Compatibility Program*). The in-line dilution required for all wastes has not been evaluated yet, but it is expected that a dilution quantity of about 33 percent will be sufficient for the most concentrated waste. Therefore the DFS must be capable of providing dilution flow rates that are as high as 33 percent of the highest diluted waste flow rate. This dilution quantity corresponds to a diluent flow rate of 0.201 m^3/min (53 gal/min) in a total waste flow of 0.606 m^3/min (160 gal/min). HNF-1939, Vol. II and an evaluation of current waste retrieval plans indicate that this diluent flow rate is appropriate.

The composition of the solution required for in-line dilution may vary, depending on the characteristics of the waste to be transferred. Waste that is transferred cannot cause the contents of the receiving DSTs to exceed chemical corrosion criteria. The contents of DSTs must meet hydroxide and nitrite concentration criteria to inhibit corrosion (OSD-T-151-00007, *Operating Specifications for the 241-AN, AP, AW, AY, AZ & SY Tank Farms*). Therefore, the DFS must be capable of adjusting the concentrations of hydroxide and nitrite from 0 M to maximum concentrations that have not yet been determined.

2.2.2.1 Process. In-line dilutions are listed in the schedule in Figure 2 in Appendix A. The in-line dilution process is described in detail in HNF-1939, Vol. II, Section 3.0. The recommended process steps for in-line dilution for a waste transfer are as follows.

1. Preheat the waste transfer line by pumping heated liquid through the line.

2. The transition from waste transfer line preheating to waste in-line dilution may be done one of two ways.

   - If the DST waste transfer pump is used to preheat the waste transfer line, adjust the DST waste transfer pump to obtain the required waste transfer flow rate. The composition of the preheat liquid may need to be adjusted because in-line diluent will be needed now.

   - If the DFS supply pump is used to preheat the waste transfer line, discontinue the preheat liquid and provide in-line diluent to the DST waste transfer pump. Adjust the DST waste transfer pump to obtain the required waste transfer flow rate.

3. Adjust the flow of dilution liquid to the DST transfer pump to obtain the desired waste density. The temperature of the dilution liquid also will be adjusted to match the waste temperature.

4. Complete the waste transfer using the required percentage of dilution liquid.

5. Conclude the waste transfer by flushing the waste transfer line.

2.2.2.2 Non-Aging Waste. The DFS must be capable of providing heated diluent for in-line dilution of non-aging DST waste. Supernatant from some non-aging waste DSTs will have very high concentrations of dissolved salts. It will be necessary to dilute this waste with a heated solution before it is transferred, to ensure that precipitation does not occur. The dilution solution must be at least as warm as the waste to be transferred.

The maximum temperature of waste that will require in-line dilution may be as high as 60 °C (140 °F). This temperature is based on the current temperatures of waste in non-aging waste DSTs, on uncertainties in DST waste retrieval plans, and on the Project W-211 design. The current temperatures of non-aging waste in DSTs are not expected to exceed 40 °C (104 °F). However, the temperatures of the waste may change between the time that this report is completed and the time that the wastes are retrieved. Due to the uncertainties that still prevail in defining the ultimate retrieval process, it is prudent to specify that the DFS be capable of providing a diluent at 60 °C (140 °F).

2.2.2.3 Aging Waste. The maximum temperature of aging waste does not lead to a requirement for the DFS. Aging waste is hotter than non-aging waste, however aging waste is not expected to be diluted in-line. Even if it is determined that aging waste must be diluted in-line, the temperature of the waste is not expected to have to be matched by the dilution solution. The temperature of dilution solutions can be below the temperatures of aging wastes, because concentrations of dissolved salts in aging waste will be significantly below levels that could precipitate.

2.2.3 Transfer Pump and Waste Transfer-Line Flushing

The DFS will provide treated flush water for concluding waste transfers. These transfers are shown in Figure 3 in Appendix A. However, many waste transfers identified in the case 3 scenario were eliminated from the schedule of flush applications, based on the reasons given below.

- Saltwell liquid transfers from SSTs to double-contained receiver tanks (DCRT) were not included, because the transfers do not directly impact DSTs, and flushes are not expected to be provided by DST subsystems.
- Transfers from the Privatization Contractor were not included in the schedule of flush applications, because the Privatization Contractor has the responsibility to manage these transfers.
- Transfers from the 242-A Evaporator facility were not included, because the River Protection Project does not have the responsibility for these transfers.
- Transfers from DCRTs (tanks with numbers beginning with 244) were included in the schedule of applications, but their impact on DFS requirements is considered to be minimal, because other subsystems address or partially address line-flushing needs, and transfers from DCRTs are planned to be completed in August 2003.

Waste transfer lines shall be flushed in a manner and timeframe that preclude settling of solids up to and including an immediate transition from transfer to flush to reduce the possibility of waste transfer line plugging. It is necessary to flush the transfer lines at a minimum flow rate or velocity to ensure that the solids in the lines are removed. A study is to be completed to verify the need to flush waste transfer lines to prevent plugging and to determine the best method for flushing the lines. The timing of waste transfer line flushing, the necessary volume of flush liquid, and the necessary flush velocity are to be determined as part of the study.

The DFS must be capable of providing quantities of flush solution that are at least twice the volume of the waste transfer lines. Existing documentation indicates that a volume of flush solution equal to one to three times the volume of a waste transfer line is necessary to flush the line. A quantity of flush solution that is equal to twice a transfer line volume is adequate to meet the intent of the documentation. The volume of flush solution that may be needed to flush a cross-site waste transfer line would be approximately 114.0 m^3 (30,000 gal). Flush volumes for other transfer lines would be less and may be readily calculated using the sizes and lengths of the lines. The DFS capability to provide these volumes of flush solution is consistent with HNF-1939; Vol. II; BNFL-5193-ID-19, *Interface Control Document Between DOE and BNFL Inc. for Low-Activity Waste Feed*; and BNFL-5193-ID-20 *Interface Control Document Between DOE and BNFL Inc. for High-Level Waste Feed.*

The compositions of waste transfer line flush solutions must be adjusted to reduce corrosion of the lines. An engineering study determined that the hydroxide concentration in flush solutions should be at least 0.01 M and the nitrite concentration should be at least 0.011 M to reduce corrosion. The study was documented as Internal Memorandum 7F540-94-019, "Projects W-058/W-028 Material of Construction Position Paper," dated June 10, 1994, and signed or approved by G. L. Parsons. The results of this study are supported by memorandums by Mark Manderbach, Fluor Daniel Northwest, dated August 11, 1998, and by R. P Anantatmula, dated January 10, 1995. In addition, the flush solution composition requirements are consistent with BNFL-5193-ID-19 and BNFL-5193-ID-20. Therefore, the DFS must be capable of preparing and supplying waste transfer line flush solutions that meet these requirements. An alternate approach to treating waste transfer line flush water with both hydroxide and nitrite is to treat the flush water with hydroxide at a much higher concentration. The concentration of hydroxide that would be required should be determined and documented if this approach were used.

The method for flushing waste transfer lines will vary depending on whether a waste transfer includes in-line dilution and depending on the routing of the flush solution. The flow rate and possibly the composition of the solution will have to be adjusted to meet the flush-solution requirements when a transition from in-line dilution to flushing is made. The DFS should be capable of making these adjustments without stopping the flow of solution because this may be necessary to prevent the accumulation of solids in most transfer lines. Waste transfer line flushes may be accomplished by using the DFS supply pumps to route flush solutions to the waste transfer pumps or by using the DFS supply pumps to flush the lines. The DFS supply pumps must be adequately sized to ensure they are capable of flushing the waste transfer lines.

2.2.4 In-Tank Dilution

In-tank dilutions will be performed to adjust the waste characteristics to meet waste-retrieval criteria and to recover soluble waste. In-tank dilutions are identified in the schedule in Figure 2 in Appendix A. In-tank dilutions will be performed to dissolve salt sludges in several tanks after the supernatants have been removed. The salt sludges will be dissolved by adding needed quantities of heated water, or a heated and chemically adjusted solution, and mixing the tank. Only four tanks were identified as requiring in-tank dilution to remove soluble wastes. In-tank dilutions were not included in the case 3 scenario, but several were identified in HNF-1939, Vol. II, Rev. 0b and Rev. 0c.

Water used for in-tank dilution should be heated to the temperature of the waste to be diluted, to aid in the dissolution of soluble material. This requirement is described in HNF-1939, Vol. II where tanks requiring in-tank dilution are addressed. The maximum temperature that will be required for dilution water is based on current waste temperatures, on uncertainties in DST waste retrieval plans, and on the Project W-211 design. The maximum temperature of waste in non-aging waste tanks that will require in-tank dilution is not expected to exceed 60 °C (140 °F). The maximum expected temperature includes the assumption that aging waste will not require in-tank dilution to dissolve solids.

Chemical adjustment may be necessary for tanks that require in-tank dilution. The large quantities of liquid required to dilute soluble materials in these tanks have the potential to cause these tanks to exceed tank corrosion criteria. Evaluations have not been completed to determine whether and how much chemical adjustment will be required. However, the DFS must be capable of making these adjustments.

The quantity of solution used for in-tank dilutions should be monitored and controlled. About 1,000 m^3 (260,000 gal) will have to be added to accomplish a typical in-tank dilution. It will take about two days to add this quantity of liquid at the flow rate of 0.53 m^3/min (140 gal/min), which is specified in HNF-1939, Vol. II. The quantity of liquid added to the tanks should be monitored and automatically limited to ensure that the tanks are not overfilled.

2.2.5 Tank-Heel Flushing

The case 3 scenario was used to identify tank-heel flush applications for the DFS. Tank-heel flushes will be performed on the remains of one batch of waste in a staging tank to prepare the staging tank for a new batch of waste. The flushes are intended to prevent one batch of waste from causing a succeeding batch of waste to exceed waste specifications. Waste heels in staging tanks will be "washed" after a batch of waste is removed from a staging tank, to prepare for a new batch of waste with a different composition. Tank-heel flushes are listed in the schedule in Figure 2 in Appendix A.

The tank-heel flushing application is documented in the case 3 scenario and is described in the *Low-Level Waste Feed Staging Plan*, WHC-SD-WM-RPT-224. The case 3 scenario indicates that tank-heel flushing will be necessary for every transition from a category of waste to a different category of waste in a feed staging tank. However, this may be conservative, because evaluations may determine that some transitions do not require tank-heel flushes. In addition, the case 3 scenario indicates that 530 m^3 (140,000 gal) will be used for each tank-heel flush, but further evaluation may determine that smaller quantities are adequate.

The temperature of the water used for tank-heel flushing must be at least as high as the temperature of the batch of waste that was in the tank and that produced the waste heel. This is necessary to ensure that there is no precipitation of the constituents in the waste. The maximum temperature of waste that may need to be flushed from the tanks is not expected to exceed 60 °C (140 °F). The tank contents must be well mixed after flush water is added, to aid in the dissolution of the remaining waste and to resuspend particles.

2.2.6 Single-Shell Tank Retrieval

It is planned that the DFS will provide solutions to be used for retrieving SST wastes. The schedule for SST-to-DST retrieval activities is provided in Figure 4 in Appendix A. The solutions are to be provided to DSTs, which will be used as reservoirs for waste-retrieval solutions. Liquids from the source DSTs will be pumped, probably under high pressure, to SSTs to mobilize solids. The mobilized solids then will be pumped back to the source DSTs. The solution is expected to be reused until the SSTs are adequately cleaned.

The chemical composition of liquid used to mobilize solid wastes in the SSTs will have to be adjusted to ensure that the waste retrieved from the SSTs will not cause the contents of DSTs to exceed corrosion criteria. Composition requirements that apply to the DSTs do not apply to the SSTs; therefore, the contents of the SSTs are not expected to meet the DST criteria in many cases. The contents of the DSTs must meet hydroxide and nitrite concentration criteria. Hydroxide and nitrite may need to be added to the mobilizing solution that is provided to the DST source tanks to ensure that the corrosion criteria are maintained.

The need to use heated solutions to retrieve SST waste has not been evaluated yet. Significant benefit possibly could be obtained for retrieving SST waste by using heated solutions. This possible requirement must be evaluated to adequately characterize the requirements for the DFS and to ensure that the most effective method for SST waste retrieval is used.

Waste retrieved by solids mobilization should not exceed 10 wt% solids or a 5.0 M concentration of sodium. This is a simplifying assumption made in the absence of accurate composition data for specific tanks, and it is documented in HNF-SD-WM-SP-012. Therefore, the DFS must be capable of providing sufficient solution to dilute wastes below these target maximums. The quantity may be provided by the DFS at several different times to support waste retrieval from a given SST.

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3.0 ADDITIONAL DEMANDS ON THE DOUBLE-SHELL TANK DILUENT AND FLUSH SUBSYSTEM

3.1 DOUBLE-SHELL TANK DILUENT AND FLUSH SUBSYSTEM RESPONSIVENESS

Changes in liquid flow rates will be necessary to address the process requirements described in Section 2.0. Figure 1 shows the flow rate changes that take place during waste transfer start-up, waste transfer with in-line dilution, and waste transfer-line flushing for a typical waste transfer. It is clear that the DFS will have to make changes in the flow rate when line preheating is completed and the dilution flow begins, and again when the dilution flow ends and the flush begins.

There will be times when in-line dilution must be performed soon after a flush in the same DST farm. Therefore, the DFS must be capable of supporting this transition within a 24-hour period according to the case 3 scenario. In addition, the DFS must be capable of providing flow rates of dilution solutions that are within a specified range to prevent precipitation and also to prevent over dilution.

The DFS must be capable of changing the compositions of the solutions that are supplied. Changes in solution compositions will be necessary when in-line dilutions are completed and flushing of waste transfer lines begins, because the compositions of the waste transfer-line flushing solutions generally will be different from the compositions of the in-line dilution solutions.

3.2 DILUENT AND FLUSH SUBSYSTEM CAPABILITIES

The DFS must be designed to handle the concentrated forms of NaOH and $NaNO_2$, because the dilution and flush solutions will have to be adjusted with these chemicals. If liquid solutions are used, the likely maximum concentrations of NaOH and $NaNO_2$ that may be obtained from a supplier are 50 percent and 40 percent by weight, respectively. Therefore, the subsystem must be designed to handle storage, transport, and mixing requirements for these concentrations.

Freeze protection of the subsystem must be addressed for concentrated as well as for dilute chemical solutions. The freezing point of a 50 percent by weight NaOH solution is about 10 °C (50 °F). Additionally, it is necessary to consider the potential for freezing for dilute solutions that may be stored in the subsystem or retained in transfer lines.

Waste transfer lines are buried and insulated, but freezing of material in the lines is still a possibility. One method of preventing freezing is to reduce the maximum concentrations of solutions transferred through the lines. A 30 percent by weight solution of NaOH has a freezing point similar to that of water. A solution of this concentration could be transferred through buried transfer lines with the same precautions used to transfer water through the lines. An alternate approach to preventing freezing of concentrated caustic solutions (especially 50 percent solutions) in transfer lines is to preheat the lines, ensure that the concentrated solution is warm enough to prevent cooling to the freezing point during transfer, and flush the lines to ensure that residual solution does not freeze. This approach would be necessary if concentrated caustic solutions were transported through the lines, but may be used for less concentrated solutions as well. Either of these approaches is feasible.

The DFS must be designed to withstand the maximum pressures of the waste transfer pipelines to provide maximum operational flexibility and a measure of safety. The subsystem must be capable of providing flush solutions to flush the entire lengths of waste transfer lines and must be capable of providing an adequate flow of preheat liquid to preheat transfer lines. The DFS must be designed to meet a minimum system design pressure to ensure it is capable of providing the needed preheat and flush flow rates.

3.3 ROUTING OF SOLUTIONS

The pumping of solutions for waste transfer-line preheating and for flushing waste transfer lines may be done by two different methods. The first method involves supplying solutions to the intake of the waste transfer pumps. This method takes advantage of the size and power of the waste transfer pumps to move flush and diluent solutions through waste transfer lines. The second method is to use the DFS supply pumps to move solutions through the waste transfer lines. The DFS supply pumps should be sized appropriately to pump water for preheating through the complete transfer route or to flush waste transfer lines from valve pits to destination DSTs.

It is not feasible to always rely on transfer pumps to move preheat and flush solutions through waste transfer lines. Transfer pumps should be readily available for flushing piping after waste transfers are completed. However, sudden and unexpected problems with transfer pumps would require the immediate use of an alternate method to flush lines. Additionally, an alternate method to support the waste transfer-line preheat function should provide added flexibility. DFS pumps that are large enough to move liquids through waste transfer routes at the required velocities and volumes would provide this flexibility. Therefore, a requirement was identified to have solution-supply pumps that are large enough to move preheat and flush solutions through waste transfer lines.

Regarding the in-line dilution application, it is a much better practice to route dilution solutions to the transfer pump intake rather than to require subsystem supply pumps to pump the solutions to valve pits for in-line dilution. Providing in-line dilution solutions to the intake of transfer pumps should significantly reduce the possibility of waste entering the DFS, because a line that supplies dilution solution would not have to overcome the pressure of waste during a waste transfer. In addition, the flow rates of solutions should be easier to control if solutions are supplied to the transfer pump rather than to a pressurized waste transfer line. Therefore, the DFS should be isolated from waste transfer lines during waste transfers. The DFS should provide diluent to the intake of waste transfer pumps to perform in-line dilutions.

3.4 SIMULTANEOUS DEMANDS ON A SUBSYSTEM

Concurrent demands on the DFS were evaluated to determine its required capabilities. The number and locations of DFS stations are uncertain; therefore, the concurrent demands for all DST tank farms were evaluated, rather than evaluating the demands at individual tank farms or groups of tank farms. The need to support several demands at one time was evaluated to determine the maximum capabilities of the DFS. The case 3 scenario was used as the basis for evaluating demands on the DFS. The HTWOS model revisions or new scenarios may affect the timing of individual DFS applications.

No basis was found for a requirement to address concurrent applications for in-line dilution, in-tank dilution, and tank-heel flushing. These applications require large quantities of heated and sometimes treated water, but no two of these applications require solution at the same time. However, waste transfer-line flushing will have to be done concurrently with in-line dilution, in-tank dilution, and tank-heel flushing according to the case 3 model. The schedule in Figure 5 in Appendix A shows the overlapping demands of these applications. Figure 5 was based on the case 3 scenario in HNF-SD-WM-SP-012, Rev. 1.

Including criteria in the HTWOS model to prevent simultaneous demands could reschedule operations to reduce the impact on the DFS. This criterion was not part of the HTWOS model and was not reflected in the case 3 scenario at the time this document was prepared. There are plans to include criteria in the HTWOS model to prevent concurrent uses of the DFS for waste transfer line flushes and in-line dilution, in-tank dilution, or tank-heel flushing. The impact of this change on the waste retrieval schedule will be evaluated to determine whether the impact is acceptable.

As shown in Figure 5, there are apparently simultaneous requirements for waste transfer-line flushes. More than one waste transfer-line flush will be required during numerous 24-hour periods. Some of the potentially simultaneous flushes occur in individual DST farms. However, the time required to perform a waste transfer-line flush is expected to be much less than one day. Theoretically, several waste transfer-line flushes easily could be performed in one day by a single DFS. In addition, waste transfers—and therefore waste transfer-line flushes—may be rescheduled by including appropriate criteria in the waste transfer model. Therefore, no requirement to supply simultaneous flushes exists because there is no clear evidence that simultaneous waste transfer-line flushes are needed.

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APPENDIX A

FIGURES

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CONTENTS

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Figure A-1. In-Line Dilutions, In-Tank Dilutions, and Tank-Heel Flushes. (4 Sheets)

ID	Task Name	Start	Finish
1	In Tank Dilution: SY-102	Fri 10/1/99	Mon 10/4/99
2	In Tank Dilution: SY-101	Wed 10/6/99	Thu 10/7/99
3	In Line Dilution: SY-101 to SY-102	Wed 3/1/00	Sun 3/5/00
4	Tank Heel Flush: AN-101	Thu 3/6/03	Fri 3/7/03
5	Tank Heel Flush: AN-101	Tue 3/18/03	Wed 3/19/03
6	In Line Dilution: AN-107 to AN-106	Fri 9/2/05	Mon 9/5/05
7	In Line Dilution: AN-107 to AN-106	Mon 9/5/05	Wed 9/7/05
8	Tank Heel Flush: AN-101	Wed 9/7/05	Thu 9/8/05
9	In Line Dilution: AN-104 to AN-101	Fri 9/9/05	Tue 9/13/05
10	In Tank Dilution: AN-104	Wed 9/14/05	Mon 9/19/05
11	In Line Dilution: AN-102 to AN-106	Fri 12/9/05	Tue 12/13/05
12	Tank Heel Flush: AN-101	Mon 1/7/08	Tue 1/8/08
13	In Line Dilution: AN-102 to AN-101	Wed 1/9/08	Sun 1/13/08
14	Tank Heel Flush: AN-104	Fri 9/12/08	Mon 9/15/08
15	In Line Dilution: AN-105 to AN-104	Tue 9/16/08	Sat 9/20/08
16	In Tank Dilution: AN-105	Mon 9/22/08	Fri 9/26/08
17	Tank Heel Flush: AN-106	Mon 6/1/09	Tue 6/2/09
18	In Line Dilution: AN-103 to AN-105	Wed 2/16/11	Sun 2/20/11
19	In Tank Dilution: AN-103	Mon 2/21/11	Sat 2/26/11
20	Tank Heel Flush: AN-106	Fri 8/12/11	Mon 8/15/11
21	Tank Heel Flush: AN-106	Tue 8/16/11	Wed 8/17/11
22	In Line Dilution: AW-101 to AN-106	Thu 8/18/11	Tue 8/23/11
23	In Tank Dilution: AW-101	Wed 8/24/11	Mon 8/29/11
24	Tank Heel Flush: AN-101	Wed 1/4/12	Thu 1/5/12
25	Tank Heel Flush: AN-105	Tue 4/17/12	Wed 4/18/12
26	Tank Heel Flush: AN-105	Fri 4/20/12	Mon 4/23/12
27	In Line Dilution: AW-104 to AN-105	Tue 4/24/12	Sat 4/28/12

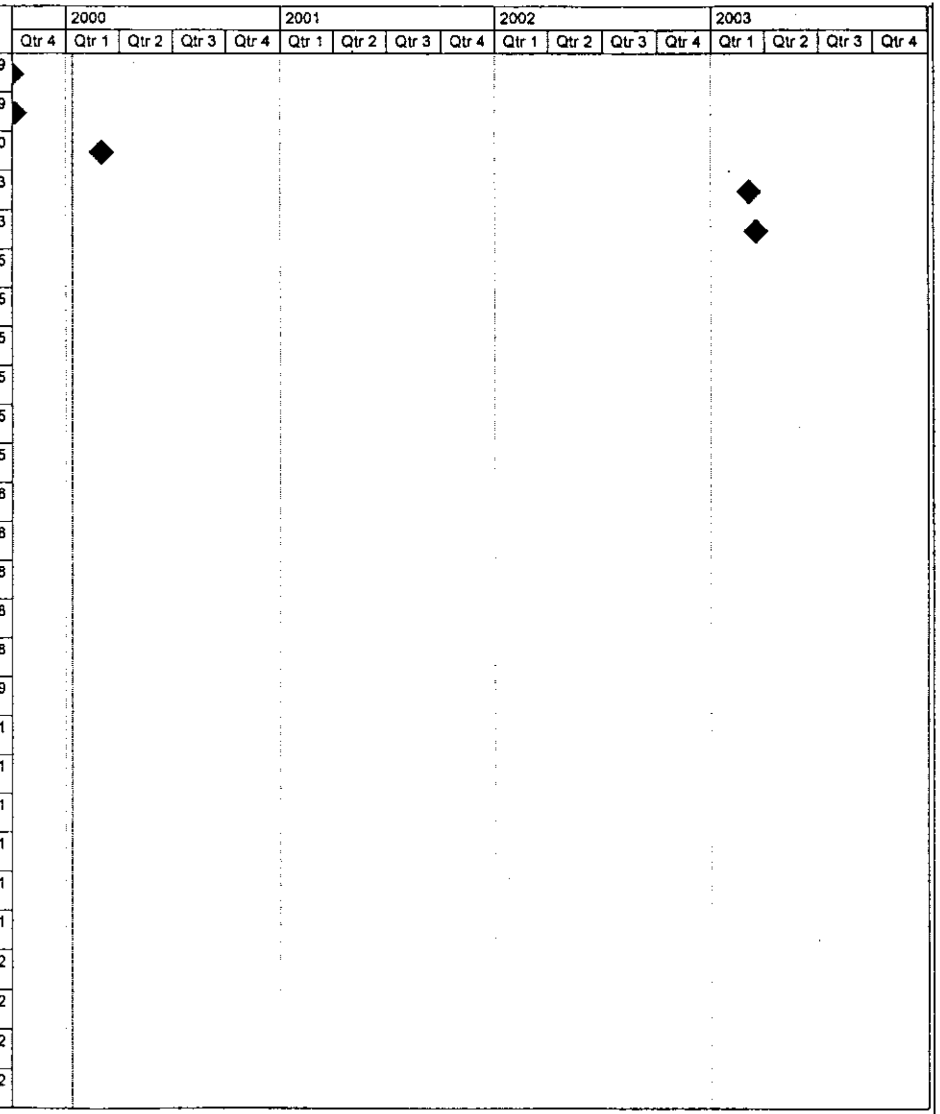

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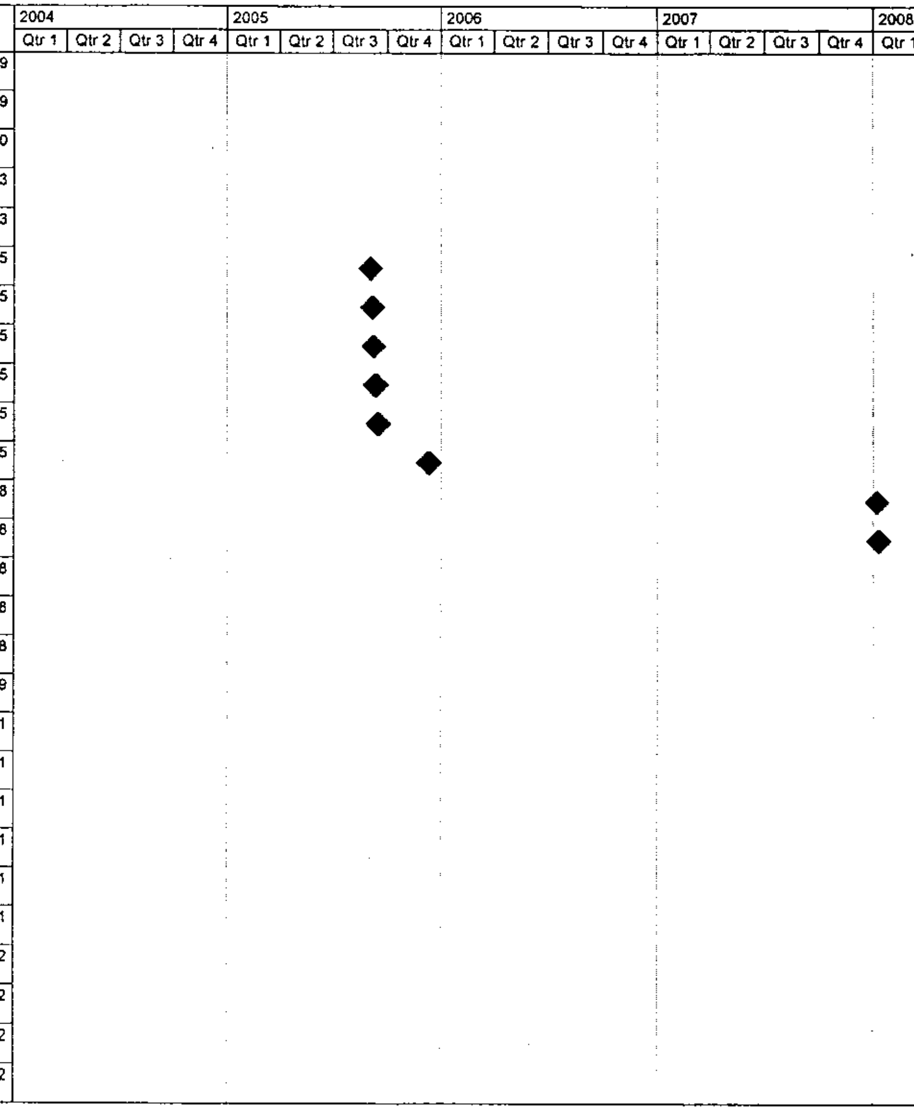
Figure A-1. In-Line Dilutions, In-Tank Dilutions, and Tank-Heel Flushes. (4 Sheets)

ID	Task Name	Start	Finish
1	In Tank Dilution: SY-102	Fri 10/1/99	Mon 10/4/99
2	In Tank Dilution: SY-101	Wed 10/6/99	Thu 10/7/99
3	In Line Dilution: SY-101 to SY-102	Wed 3/1/00	Sun 3/5/00
4	Tank Heel Flush: AN-101	Thu 3/6/03	Fri 3/7/03
5	Tank Heel Flush: AN-101	Tue 3/18/03	Wed 3/19/03
6	In Line Dilution: AN-107 to AN-106	Fri 9/2/05	Mon 9/5/05
7	In Line Dilution: AN-107 to AN-106	Mon 9/5/05	Wed 9/7/05
8	Tank Heel Flush: AN-101	Wed 9/7/05	Thu 9/8/05
9	In Line Dilution: AN-104 to AN-101	Fri 9/9/05	Tue 9/13/05
10	In Tank Dilution: AN-104	Wed 9/14/05	Mon 9/19/05
11	In Line Dilution: AN-102 to AN-106	Fri 12/9/05	Tue 12/13/05
12	Tank Heel Flush: AN-101	Mon 1/7/08	Tue 1/8/08
13	In Line Dilution: AN-102 to AN-101	Wed 1/9/08	Sun 1/13/08
14	Tank Heel Flush: AN-104	Fri 9/12/08	Mon 9/15/08
15	In Line Dilution: AN-105 to AN-104	Tue 9/16/08	Sat 9/20/08
16	In Tank Dilution: AN-105	Mon 9/22/08	Fri 9/26/08
17	Tank Heel Flush: AN-106	Mon 6/1/09	Tue 6/2/09
18	In Line Dilution: AN-103 to AN-105	Wed 2/16/11	Sun 2/20/11
19	In Tank Dilution: AN-103	Mon 2/21/11	Sat 2/26/11
20	Tank Heel Flush: AN-106	Fri 8/12/11	Mon 8/15/11
21	Tank Heel Flush: AN-106	Tue 8/16/11	Wed 8/17/11
22	In Line Dilution: AW-101 to AN-106	Thu 8/18/11	Tue 8/23/11
23	In Tank Dilution: AW-101	Wed 8/24/11	Mon 8/29/11
24	Tank Heel Flush: AN-101	Wed 1/4/12	Thu 1/5/12
25	Tank Heel Flush: AN-105	Tue 4/17/12	Wed 4/18/12
26	Tank Heel Flush: AN-105	Fri 4/20/12	Mon 4/23/12
27	In Line Dilution: AW-104 to AN-105	Tue 4/24/12	Sat 4/28/12



Page 2

Figure A-1. In-Line Dilutions, In-Tank Dilutions, and Tank-Heel Flushes. (4 sheets)

ID	Task Name	Start	Finish
1	In Tank Dilution: SY-102	Fri 10/1/99	Mon 10/4/99
2	In Tank Dilution: SY-101	Wed 10/6/99	Thu 10/7/99
3	In Line Dilution: SY-101 to SY-102	Wed 3/1/00	Sun 3/5/00
4	Tank Heel Flush: AN-101	Thu 3/6/03	Fri 3/7/03
5	Tank Heel Flush: AN-101	Tue 3/18/03	Wed 3/19/03
6	In Line Dilution: AN-107 to AN-106	Fri 9/2/05	Mon 9/5/05
7	In Line Dilution: AN-107 to AN-106	Mon 9/5/05	Wed 9/7/05
8	Tank Heel Flush: AN-101	Wed 9/7/05	Thu 9/8/05
9	In Line Dilution: AN-104 to AN-101	Fri 9/9/05	Tue 9/13/05
10	In Tank Dilution: AN-104	Wed 9/14/05	Mon 9/19/05
11	In Line Dilution: AN-102 to AN-106	Fri 12/9/05	Tue 12/13/05
12	Tank Heel Flush: AN-101	Mon 1/7/08	Tue 1/8/08
13	In Line Dilution: AN-102 to AN-101	Wed 1/9/08	Sun 1/13/08
14	Tank Heel Flush: AN-104	Fri 9/12/08	Mon 9/15/08
15	In Line Dilution: AN-105 to AN-104	Tue 9/16/08	Sat 9/20/08
16	In Tank Dilution: AN-105	Mon 9/22/08	Fri 9/26/08
17	Tank Heel Flush: AN-106	Mon 6/1/09	Tue 6/2/09
18	In Line Dilution: AN-103 to AN-105	Wed 2/16/11	Sun 2/20/11
19	In Tank Dilution: AN-103	Mon 2/21/11	Sat 2/26/11
20	Tank Heel Flush: AN-106	Fri 8/12/11	Mon 8/15/11
21	Tank Heel Flush: AN-106	Tue 8/16/11	Wed 8/17/11
22	In Line Dilution: AW-101 to AN-106	Thu 8/18/11	Tue 8/23/11
23	In Tank Dilution: AW-101	Wed 8/24/11	Mon 8/29/11
24	Tank Heel Flush: AN-101	Wed 1/4/12	Thu 1/5/12
25	Tank Heel Flush: AN-105	Tue 4/17/12	Wed 4/18/12
26	Tank Heel Flush: AN-105	Fri 4/20/12	Mon 4/23/12
27	In Line Dilution: AW-104 to AN-105	Tue 4/24/12	Sat 4/28/12

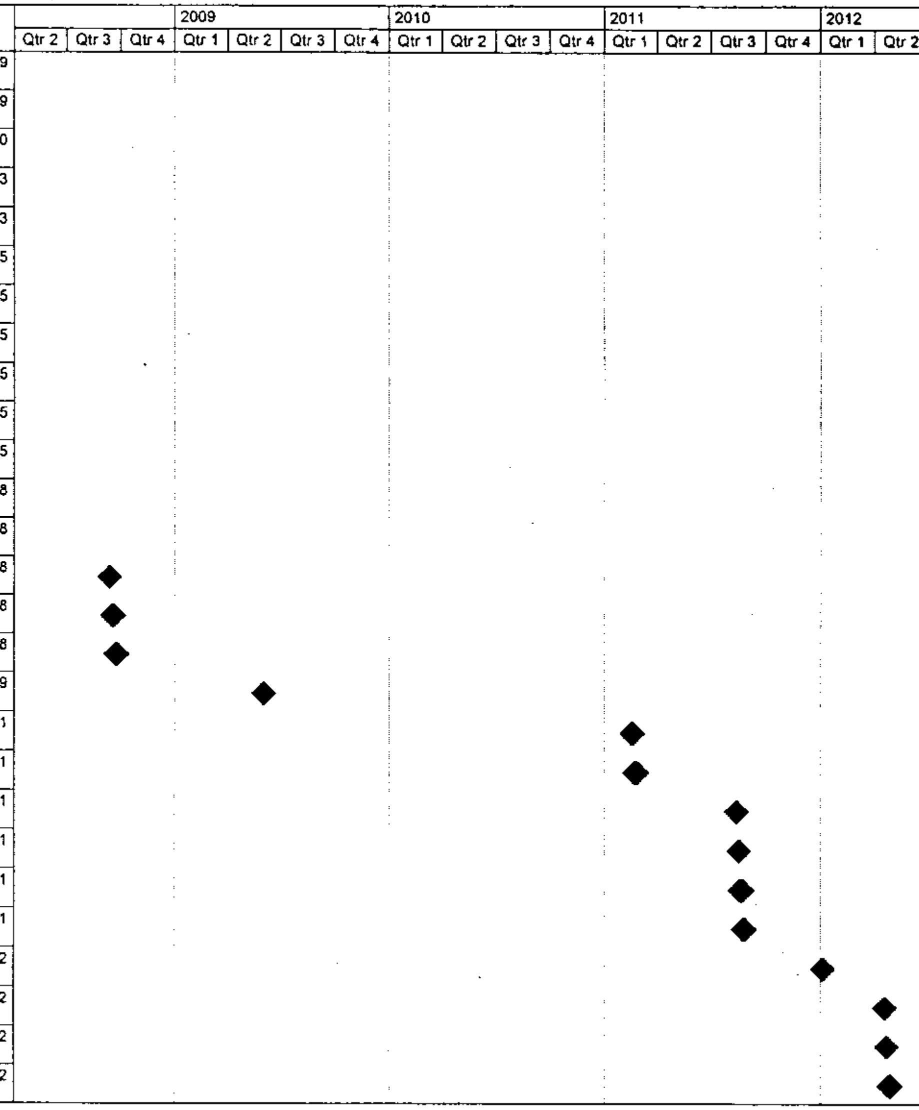


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Figure A-1. In-Line Dilutions, In-Tank Dilutions, and Tank-Heel Flushes. (4 Sheets)

ID		Task Name	Start	Finish
28		Tank Heel Flush: AN-106	Tue 6/18/13	Wed 6/19/13
29		In Line Dilution: AP-105 to AN-106	Thu 6/20/13	Mon 6/24/13
30		Tank Heel Flush: AN-101	Wed 6/25/14	Thu 6/26/14
31		In Line Dilution: AP-105 to AN-101	Fri 6/27/14	Wed 7/2/14
32		In Line Dilution: AP-104 to AN-105	Thu 12/18/14	Sun 12/21/14
33		In Line Dilution: AP-104 to AN-106	Fri 5/29/15	Tue 6/2/15
34		In Line Dilution: AP-101 to AN-101	Thu 12/10/15	Mon 12/14/15
35		In Line Dilution: AP-101 to AN-105	Tue 6/21/16	Sat 6/25/16

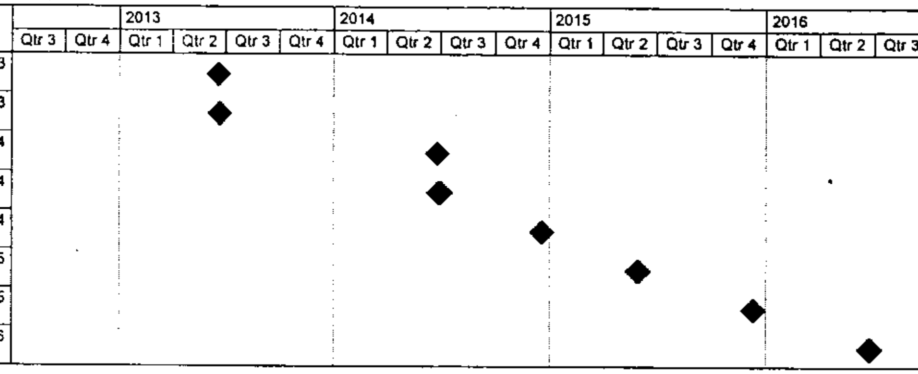

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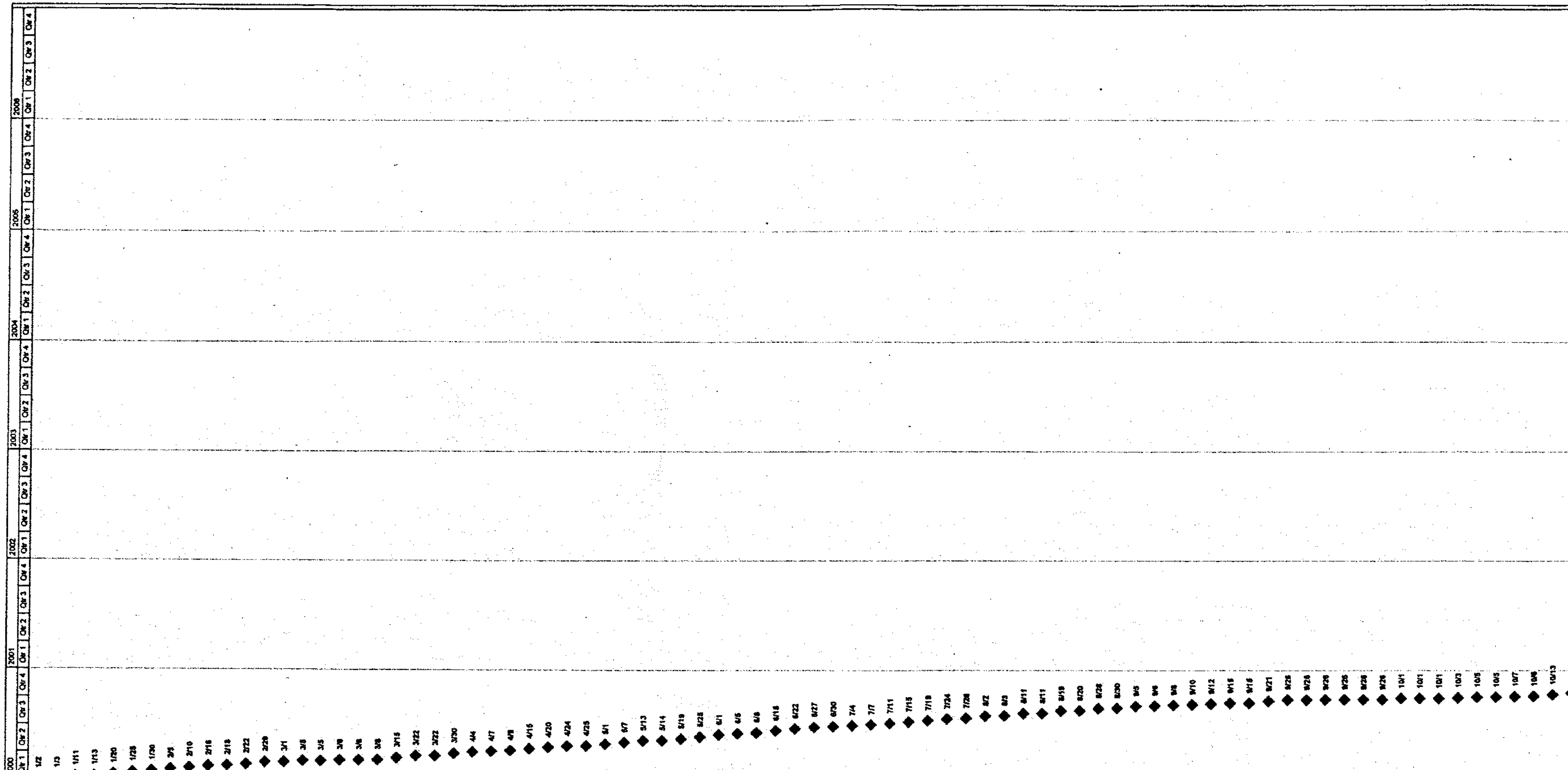
Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)



ID	Task Name	Start	Finish
1	244-U-SY-102	Sun 1/2/00	Sun 1/2/00
2	244-S-SY-102	Mon 1/3/00	Mon 1/3/00
3	244-U-SY-102	Tue 1/11/00	Tue 1/11/00
4	244-S-SY-102	Thu 1/13/00	Thu 1/13/00
5	244-U-SY-102	Thu 1/20/00	Thu 1/20/00
6	244-S-SY-102	Tue 1/25/00	Tue 1/25/00
7	244-U-SY-102	Sun 1/30/00	Sun 1/30/00
8	244-S-SY-102	Sat 2/5/00	Sat 2/5/00
9	244-U-SY-102	Thu 2/10/00	Thu 2/10/00
10	244-U-SY-102	Wed 2/16/00	Wed 2/16/00
11	244-S-SY-102	Fri 2/18/00	Fri 2/18/00
12	244-U-SY-102	Tue 2/22/00	Tue 2/22/00
13	244-U-SY-102	Tue 2/29/00	Tue 2/29/00
14	SY-102-AP-107	Wed 3/1/00	Wed 3/1/00
15	SY-101-SY-102	Sun 3/5/00	Sun 3/5/00
16	SY-101-SY-102	Sun 3/5/00	Sun 3/5/00
17	244-S-SY-102	Wed 3/8/00	Wed 3/8/00
18	244-U-SY-102	Wed 3/8/00	Wed 3/8/00
19	SY-102-AP-108	Wed 3/8/00	Wed 3/8/00
20	244-U-SY-102	Wed 3/15/00	Wed 3/15/00
21	244-S-SY-102	Wed 3/22/00	Wed 3/22/00
22	244-U-SY-102	Wed 3/22/00	Wed 3/22/00
23	244-U-SY-102	Thu 3/30/00	Thu 3/30/00
24	244-U-SY-102	Tue 4/4/00	Tue 4/4/00
25	244-S-SY-102	Fri 4/7/00	Fri 4/7/00
26	244-U-SY-102	Sun 4/9/00	Sun 4/9/00
27	244-U-SY-102	Sat 4/15/00	Sat 4/15/00
28	244-U-SY-102	Thu 4/20/00	Thu 4/20/00
29	244-S-SY-102	Mon 4/24/00	Mon 4/24/00
30	244-U-SY-102	Tue 4/25/00	Tue 4/25/00
31	244-U-SY-102	Mon 5/1/00	Mon 5/1/00
32	244-U-SY-102	Sun 5/7/00	Sun 5/7/00
33	244-U-SY-102	Sat 5/13/00	Sat 5/13/00
34	244-S-SY-102	Sun 5/14/00	Sun 5/14/00
35	244-U-SY-102	Fri 5/19/00	Fri 5/19/00
36	244-U-SY-102	Thu 5/25/00	Thu 5/25/00
37	244-U-SY-102	Thu 6/1/00	Thu 6/1/00
38	244-S-SY-102	Mon 6/5/00	Mon 6/5/00
39	244-U-SY-102	Thu 6/8/00	Thu 6/8/00
40	244-U-SY-102	Thu 6/15/00	Thu 6/15/00
41	244-U-SY-102	Thu 6/22/00	Thu 6/22/00
42	244-S-SY-102	Tue 6/27/00	Tue 6/27/00
43	244-U-SY-102	Fri 6/30/00	Fri 6/30/00
44	244-S-SY-102	Tue 7/4/00	Tue 7/4/00
45	244-U-SY-102	Fri 7/7/00	Fri 7/7/00
46	244-S-SY-102	Tue 7/11/00	Tue 7/11/00
47	244-U-SY-102	Sat 7/15/00	Sat 7/15/00
48	244-S-SY-102	Wed 7/19/00	Wed 7/19/00
49	244-U-SY-102	Mon 7/24/00	Mon 7/24/00
50	244-S-SY-102	Wed 7/26/00	Wed 7/26/00
51	244-U-SY-102	Wed 8/2/00	Wed 8/2/00
52	244-S-SY-102	Thu 8/3/00	Thu 8/3/00
53	244-S-SY-102	Fri 8/11/00	Fri 8/11/00
54	244-U-SY-102	Fri 8/11/00	Fri 8/11/00
55	244-S-SY-102	Sat 8/19/00	Sat 8/19/00
56	244-U-SY-102	Sun 8/20/00	Sun 8/20/00
57	244-S-SY-102	Mon 8/28/00	Mon 8/28/00
58	244-U-SY-102	Wed 8/30/00	Wed 8/30/00
59	244-S-SY-102	Tue 9/5/00	Tue 9/5/00
60	SY-102-AP-107	Wed 9/6/00	Wed 9/6/00
61	AP-107-AW-102	Fri 9/8/00	Fri 9/8/00
62	SY-102-AP-107	Sun 9/10/00	Sun 9/10/00
63	AW-102-242-A	Tue 9/12/00	Tue 9/12/00
64	AW-106-AW-102	Fri 9/15/00	Fri 9/15/00
65	AW-106-AW-102	Fri 9/15/00	Fri 9/15/00
66	AW-102-242-A	Thu 9/21/00	Thu 9/21/00
67	244-S-SY-102	Tue 9/26/00	Tue 9/26/00
68	244-U-SY-102	Tue 9/26/00	Tue 9/26/00
69	AP-107-AW-102	Tue 9/26/00	Tue 9/26/00
70	AW-102-242-A	Tue 9/26/00	Tue 9/26/00
71	AW-102-242-A	Tue 9/26/00	Tue 9/26/00
72	SY-102-AP-107	Tue 9/26/00	Tue 9/26/00
73	AW-102-242-A	Sun 10/1/00	Sun 10/1/00
74	AW-106-AW-104	Sun 10/1/00	Sun 10/1/00
75	AW-106-AW-104	Sun 10/1/00	Sun 10/1/00
76	244-S-SY-102	Tue 10/3/00	Tue 10/3/00
77	AW-106-AP-101	Thu 10/5/00	Thu 10/5/00
78	AW-106-AP-101	Thu 10/5/00	Thu 10/5/00
79	244-U-SY-102	Sat 10/7/00	Sat 10/7/00
80	244-S-SY-102	Sun 10/8/00	Sun 10/8/00
81	244-S-SY-102	Fri 10/13/00	Fri 10/13/00
82	244-S-SY-102	Wed 10/18/00	Wed 10/18/00

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
83	244-U-SY-102	Thu 10/19/00	Thu 10/19/00
84	244-S-SY-102	Mon 10/23/00	Mon 10/23/00
85	244-S-SY-102	Sat 10/28/00	Sat 10/28/00
86	244-U-SY-102	Wed 11/1/00	Wed 11/1/00
87	244-S-SY-102	Thu 11/2/00	Thu 11/2/00
88	244-S-SY-102	Wed 11/8/00	Wed 11/8/00
89	244-S-SY-102	Sun 11/12/00	Sun 11/12/00
90	244-U-SY-102	Tue 11/14/00	Tue 11/14/00
91	244-S-SY-102	Thu 11/16/00	Thu 11/16/00
92	244-S-SY-102	Mon 11/20/00	Mon 11/20/00
93	244-S-SY-102	Thu 11/23/00	Thu 11/23/00
94	244-S-SY-102	Mon 11/27/00	Mon 11/27/00
95	244-U-SY-102	Tue 11/28/00	Tue 11/28/00
96	244-S-SY-102	Fri 12/1/00	Fri 12/1/00
97	244-S-SY-102	Tue 12/5/00	Tue 12/5/00
98	244-S-SY-102	Sat 12/9/00	Sat 12/9/00
99	244-S-SY-102	Wed 12/13/00	Wed 12/13/00
100	244-U-SY-102	Wed 12/13/00	Wed 12/13/00
101	244-S-SY-102	Sun 12/17/00	Sun 12/17/00
102	244-S-SY-102	Thu 12/21/00	Thu 12/21/00
103	244-S-SY-102	Tue 12/26/00	Tue 12/26/00
104	244-U-SY-102	Fri 12/29/00	Fri 12/29/00
105	244-S-SY-102	Sat 12/30/00	Sat 12/30/00
106	244-S-SY-102	Thu 1/4/01	Thu 1/4/01
107	244-U-SY-102	Sat 1/6/01	Sat 1/6/01
108	244-S-SY-102	Mon 1/8/01	Mon 1/8/01
109	244-S-SY-102	Sat 1/13/01	Sat 1/13/01
110	244-U-SY-102	Sun 1/14/01	Sun 1/14/01
111	244-S-SY-102	Thu 1/18/01	Thu 1/18/01
112	244-U-SY-102	Mon 1/22/01	Mon 1/22/01
113	244-S-SY-102	Tue 1/23/01	Tue 1/23/01
114	244-S-SY-102	Sun 1/28/01	Sun 1/28/01
115	244-U-SY-102	Wed 1/31/01	Wed 1/31/01
116	244-S-SY-102	Fri 2/2/01	Fri 2/2/01
117	244-S-SY-102	Thu 2/8/01	Thu 2/8/01
118	244-U-SY-102	Sat 2/10/01	Sat 2/10/01
119	SY-102-AP-107	Sat 2/10/01	Sat 2/10/01
120	244-S-SY-102	Tue 2/13/01	Tue 2/13/01
121	244-S-SY-102	Mon 2/19/01	Mon 2/19/01
122	244-U-SY-102	Wed 2/21/01	Wed 2/21/01
123	244-S-SY-102	Sat 2/24/01	Sat 2/24/01
124	244-BX-AP-107	Sun 2/25/01	Sun 2/25/01
125	AP-107-AW-102	Wed 2/28/01	Wed 2/28/01
126	244-S-SY-102	Fri 3/2/01	Fri 3/2/01
127	244-U-SY-102	Mon 3/5/01	Mon 3/5/01
128	244-S-SY-102	Thu 3/8/01	Thu 3/8/01
129	244-BX-AP-107	Mon 3/12/01	Mon 3/12/01
130	244-S-SY-102	Wed 3/14/01	Wed 3/14/01
131	244-U-SY-102	Sat 3/17/01	Sat 3/17/01
132	244-S-SY-102	Wed 3/21/01	Wed 3/21/01
133	244-S-SY-102	Wed 3/28/01	Wed 3/28/01
134	244-BX-AP-107	Thu 3/29/01	Thu 3/29/01
135	244-U-SY-102	Sun 4/1/01	Sun 4/1/01
136	244-S-SY-102	Wed 4/4/01	Wed 4/4/01
137	244-BX-AP-107	Sun 4/8/01	Sun 4/8/01
138	244-S-SY-102	Wed 4/11/01	Wed 4/11/01
139	244-BX-AP-107	Mon 4/16/01	Mon 4/16/01
140	244-U-SY-102	Mon 4/16/01	Mon 4/16/01
141	244-S-SY-102	Wed 4/18/01	Wed 4/18/01
142	244-BX-AP-107	Wed 4/25/01	Wed 4/25/01
143	244-S-SY-102	Thu 4/26/01	Thu 4/26/01
144	244-S-SY-102	Fri 5/4/01	Fri 5/4/01
145	244-U-SY-102	Fri 5/4/01	Fri 5/4/01
146	244-BX-AP-107	Sat 5/5/01	Sat 5/5/01
147	244-S-SY-102	Sat 5/12/01	Sat 5/12/01
148	244-BX-AP-107	Mon 5/14/01	Mon 5/14/01
149	244-U-SY-102	Thu 5/17/01	Thu 5/17/01
150	244-S-SY-102	Mon 5/21/01	Mon 5/21/01
151	244-BX-AP-107	Thu 5/24/01	Thu 5/24/01
152	244-U-SY-102	Fri 5/25/01	Fri 5/25/01
153	244-S-SY-102	Wed 5/30/01	Wed 5/30/01
154	244-U-SY-102	Sun 6/3/01	Sun 6/3/01
155	244-BX-AP-107	Mon 6/4/01	Mon 6/4/01
156	244-S-SY-102	Fri 6/8/01	Fri 6/8/01
157	244-U-SY-102	Tue 6/12/01	Tue 6/12/01
158	244-BX-AP-107	Thu 6/14/01	Thu 6/14/01
159	244-S-SY-102	Mon 6/18/01	Mon 6/18/01
160	244-U-SY-102	Fri 6/22/01	Fri 6/22/01
161	244-BX-AP-107	Tue 6/26/01	Tue 6/26/01
162	244-S-SY-102	Thu 6/28/01	Thu 6/28/01
163	244-U-SY-102	Fri 6/29/01	Fri 6/29/01
164	244-U-SY-102	Thu 7/5/01	Thu 7/5/01

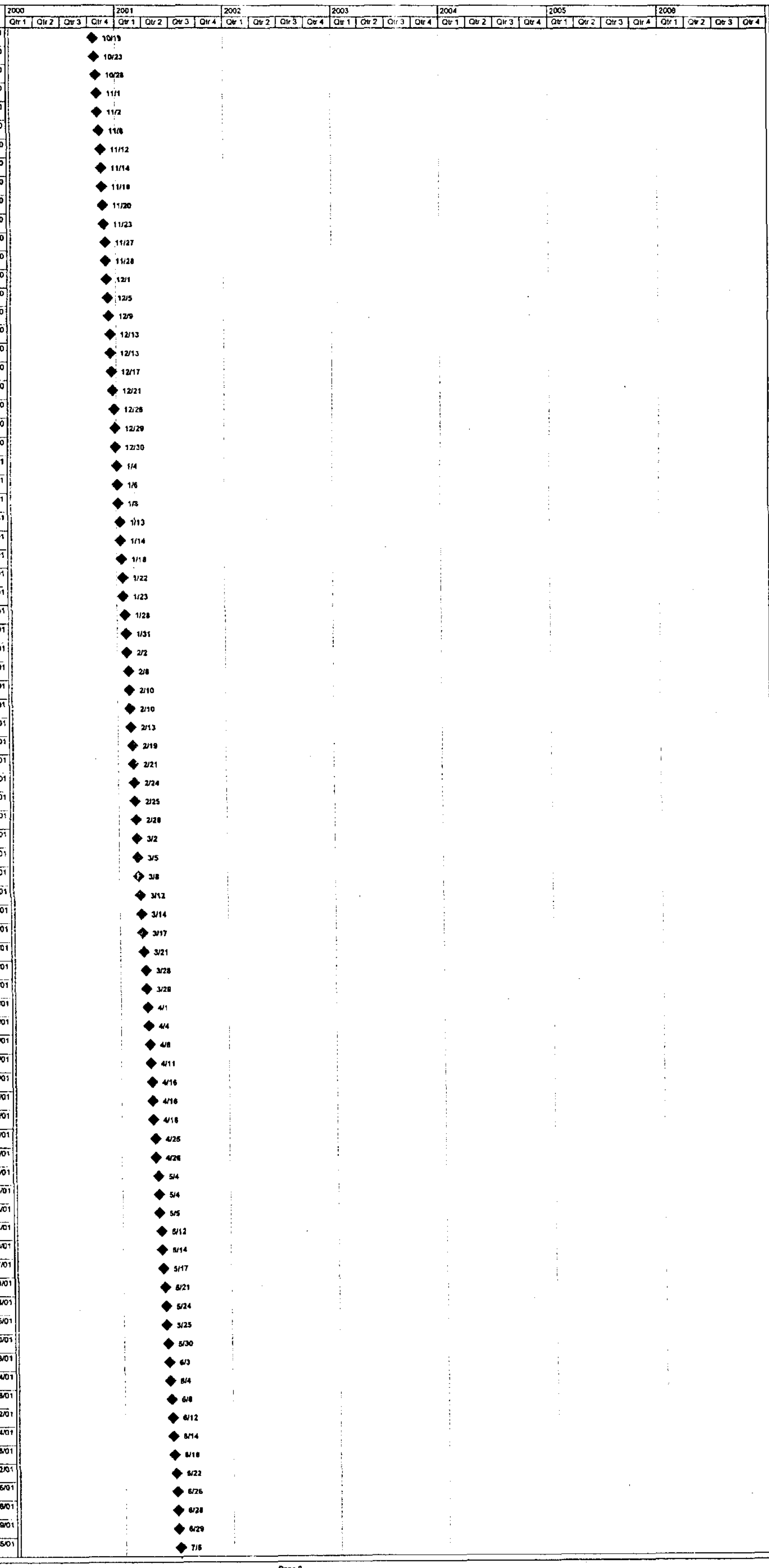

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
165	244-BX-AP-107	Sun 7/8/01	Sun 7/8/01
166	244-S-SY-102	Sun 7/8/01	Sun 7/8/01
167	244-U-SY-102	Wed 7/11/01	Wed 7/11/01
168	244-U-SY-102	Tue 7/17/01	Tue 7/17/01
169	244-S-SY-102	Thu 7/19/01	Thu 7/19/01
170	244-BX-AP-107	Fri 7/20/01	Fri 7/20/01
171	244-U-SY-102	Tue 7/24/01	Tue 7/24/01
172	244-U-SY-102	Mon 7/30/01	Mon 7/30/01
173	244-S-SY-102	Tue 7/31/01	Tue 7/31/01
174	244-BX-AP-107	Fri 8/3/01	Fri 8/3/01
175	244-U-SY-102	Mon 8/6/01	Mon 8/6/01
176	244-S-SY-102	Fri 8/10/01	Fri 8/10/01
177	SY-102-AP-107	Sun 8/12/01	Sun 8/12/01
178	244-U-SY-102	Tue 8/14/01	Tue 8/14/01
179	244-S-SY-102	Thu 8/16/01	Thu 8/16/01
180	244-BX-AP-107	Fri 8/17/01	Fri 8/17/01
181	AP-107-AW-102	Sat 8/18/01	Sat 8/18/01
182	244-U-SY-102	Tue 8/21/01	Tue 8/21/01
183	244-S-SY-102	Wed 8/22/01	Wed 8/22/01
184	AW-102-242-A	Wed 8/22/01	Wed 8/22/01
185	AW-106-AP-101	Fri 8/24/01	Fri 8/24/01
186	AW-106-AP-101	Fri 8/24/01	Fri 8/24/01
187	244-S-SY-102	Wed 8/29/01	Wed 8/29/01
188	244-U-SY-102	Wed 8/29/01	Wed 8/29/01
189	244-BX-AP-107	Sat 9/1/01	Sat 9/1/01
190	244-S-SY-102	Wed 9/5/01	Wed 9/5/01
191	244-U-SY-102	Thu 9/6/01	Thu 9/6/01
192	244-S-SY-102	Wed 9/12/01	Wed 9/12/01
193	244-U-SY-102	Sat 9/15/01	Sat 9/15/01
194	244-BX-AP-107	Mon 9/17/01	Mon 9/17/01
195	244-S-SY-102	Wed 9/19/01	Wed 9/19/01
196	244-U-SY-102	Mon 9/24/01	Mon 9/24/01
197	244-S-SY-102	Wed 9/26/01	Wed 9/26/01
198	AP-108-AP-107	Wed 9/26/01	Wed 9/26/01
199	AP-107-AW-102	Sun 9/30/01	Sun 9/30/01
200	AW-102-242-A	Tue 10/2/01	Tue 10/2/01
201	AW-102-242-A	Tue 10/2/01	Tue 10/2/01
202	244-S-SY-102	Wed 10/3/01	Wed 10/3/01
203	244-BX-AP-107	Thu 10/4/01	Thu 10/4/01
204	244-U-SY-102	Thu 10/4/01	Thu 10/4/01
205	AW-102-242-A	Sat 10/6/01	Sat 10/6/01
206	244-S-SY-102	Sun 10/7/01	Sun 10/7/01
207	AW-106-AP-104	Sun 10/7/01	Sun 10/7/01
208	AW-106-AP-104	Sun 10/7/01	Sun 10/7/01
209	AW-106-AW-105	Tue 10/9/01	Tue 10/9/01
210	AW-106-AW-105	Tue 10/9/01	Tue 10/9/01
211	244-S-SY-102	Thu 10/11/01	Thu 10/11/01
212	244-U-SY-102	Sun 10/14/01	Sun 10/14/01
213	244-S-SY-102	Tue 10/16/01	Tue 10/16/01
214	244-S-SY-102	Sun 10/21/01	Sun 10/21/01
215	244-BX-AP-107	Mon 10/22/01	Mon 10/22/01
216	244-S-SY-102	Thu 10/25/01	Thu 10/25/01
217	244-U-SY-102	Thu 10/25/01	Thu 10/25/01
218	244-S-SY-102	Tue 10/30/01	Tue 10/30/01
219	244-S-SY-102	Sun 11/4/01	Sun 11/4/01
220	244-U-SY-102	Tue 11/6/01	Tue 11/6/01
221	244-S-SY-102	Fri 11/9/01	Fri 11/9/01
222	244-BX-AP-107	Sun 11/11/01	Sun 11/11/01
223	244-S-SY-102	Wed 11/14/01	Wed 11/14/01
224	244-U-SY-102	Mon 11/19/01	Mon 11/19/01
225	244-S-SY-102	Tue 11/20/01	Tue 11/20/01
226	244-S-SY-102	Sun 11/25/01	Sun 11/25/01
227	244-S-SY-102	Sat 12/1/01	Sat 12/1/01
228	244-BX-AP-107	Sun 12/2/01	Sun 12/2/01
229	244-U-SY-102	Mon 12/3/01	Mon 12/3/01
230	244-S-SY-102	Thu 12/6/01	Thu 12/6/01
231	244-S-SY-102	Wed 12/12/01	Wed 12/12/01
232	244-U-SY-102	Mon 12/17/01	Mon 12/17/01
233	244-S-SY-102	Tue 12/18/01	Tue 12/18/01
234	244-S-SY-102	Mon 12/24/01	Mon 12/24/01
235	244-BX-AP-107	Wed 12/26/01	Wed 12/26/01
236	244-S-SY-102	Mon 12/31/01	Mon 12/31/01
237	244-U-SY-102	Wed 1/2/02	Wed 1/2/02
238	244-S-SY-102	Sun 1/6/02	Sun 1/6/02
239	244-S-SY-102	Sun 1/13/02	Sun 1/13/02
240	244-U-SY-102	Sat 1/19/02	Sat 1/19/02
241	244-BX-AP-107	Tue 1/22/02	Tue 1/22/02
242	244-S-SY-102	Tue 1/22/02	Tue 1/22/02
243	SY-102-AP-107	Tue 1/22/02	Tue 1/22/02
244	AP-107-AW-102	Sun 1/27/02	Sun 1/27/02
245	244-S-SY-102	Tue 1/29/02	Tue 1/29/02
246	244-U-SY-102	Wed 1/30/02	Wed 1/30/02

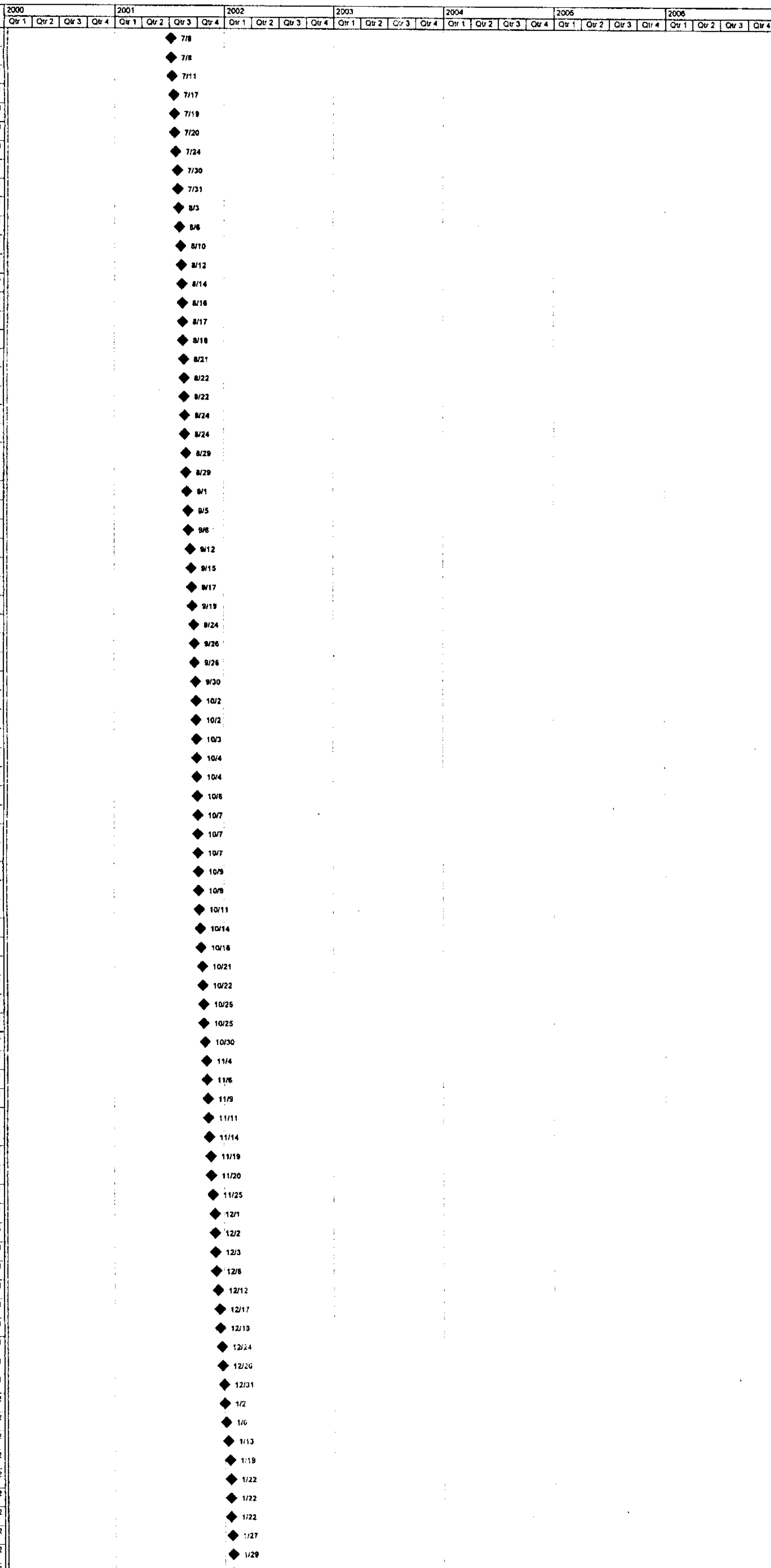

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
247	AW-102-242-A	Thu 1/31/02	Thu 1/31/02
248	AW-106-AW-105	Sun 2/3/02	Sun 2/3/02
249	AW-106-AW-105	Sun 2/3/02	Sun 2/3/02
250	244-S-SY-102	Tue 2/5/02	Tue 2/5/02
251	244-U-SY-102	Fri 2/8/02	Fri 2/8/02
252	244-S-SY-102	Wed 2/13/02	Wed 2/13/02
253	244-U-SY-102	Sun 2/17/02	Sun 2/17/02
254	244-BX-AP-107	Wed 2/20/02	Wed 2/20/02
255	244-S-SY-102	Thu 2/21/02	Thu 2/21/02
256	244-U-SY-102	Wed 2/27/02	Wed 2/27/02
257	244-S-SY-102	Fri 3/1/02	Fri 3/1/02
258	244-S-SY-102	Sat 3/9/02	Sat 3/9/02
259	244-U-SY-102	Sat 3/9/02	Sat 3/9/02
260	244-S-SY-102	Fri 3/15/02	Fri 3/15/02
261	244-U-SY-102	Tue 3/19/02	Tue 3/19/02
262	244-S-SY-102	Wed 3/20/02	Wed 3/20/02
263	244-BX-AP-107	Tue 3/26/02	Tue 3/26/02
264	244-S-SY-102	Tue 3/26/02	Tue 3/26/02
265	244-S-SY-102	Sun 3/31/02	Sun 3/31/02
266	244-U-SY-102	Sun 3/31/02	Sun 3/31/02
267	244-S-SY-102	Sat 4/6/02	Sat 4/6/02
268	244-S-SY-102	Fri 4/12/02	Fri 4/12/02
269	244-U-SY-102	Fri 4/12/02	Fri 4/12/02
270	244-S-SY-102	Thu 4/18/02	Thu 4/18/02
271	244-S-SY-102	Mon 4/22/02	Mon 4/22/02
272	244-S-SY-102	Fri 4/26/02	Fri 4/26/02
273	244-U-SY-102	Fri 4/26/02	Fri 4/26/02
274	244-S-SY-102	Tue 4/30/02	Tue 4/30/02
275	244-BX-AP-107	Sat 5/4/02	Sat 5/4/02
276	244-S-SY-102	Sat 5/4/02	Sat 5/4/02
277	244-S-SY-102	Wed 5/8/02	Wed 5/8/02
278	244-U-SY-102	Fri 5/10/02	Fri 5/10/02
279	244-S-SY-102	Sun 5/12/02	Sun 5/12/02
280	244-S-SY-102	Thu 5/16/02	Thu 5/16/02
281	244-S-SY-102	Tue 5/21/02	Tue 5/21/02
282	244-S-SY-102	Sat 5/25/02	Sat 5/25/02
283	244-U-SY-102	Sun 5/26/02	Sun 5/26/02
284	244-S-SY-102	Thu 5/30/02	Thu 5/30/02
285	244-S-SY-102	Mon 6/3/02	Mon 6/3/02
286	244-S-SY-102	Fri 6/7/02	Fri 6/7/02
287	244-S-SY-102	Tue 6/11/02	Tue 6/11/02
288	244-U-SY-102	Thu 6/13/02	Thu 6/13/02
289	244-S-SY-102	Fri 6/14/02	Fri 6/14/02
290	244-S-SY-102	Tue 6/18/02	Tue 6/18/02
291	244-BX-AP-107	Wed 6/19/02	Wed 6/19/02
292	244-S-SY-102	Sat 6/22/02	Sat 6/22/02
293	SY-102-AP-107	Mon 6/24/02	Mon 6/24/02
294	244-S-SY-102	Wed 6/26/02	Wed 6/26/02
295	244-S-SY-102	Sun 6/30/02	Sun 6/30/02
296	244-U-SY-102	Tue 7/2/02	Tue 7/2/02
297	244-S-SY-102	Thu 7/4/02	Thu 7/4/02
298	244-S-SY-102	Tue 7/9/02	Tue 7/9/02
299	244-S-SY-102	Sat 7/13/02	Sat 7/13/02
300	244-S-SY-102	Thu 7/18/02	Thu 7/18/02
301	244-S-SY-102	Mon 7/22/02	Mon 7/22/02
302	244-U-SY-102	Tue 7/23/02	Tue 7/23/02
303	244-S-SY-102	Sat 7/27/02	Sat 7/27/02
304	244-S-SY-102	Thu 8/1/02	Thu 8/1/02
305	244-S-SY-102	Tue 8/6/02	Tue 8/6/02
306	244-S-SY-102	Sun 8/11/02	Sun 8/11/02
307	244-BX-AP-107	Fri 8/16/02	Fri 8/16/02
308	244-S-SY-102	Sat 8/17/02	Sat 8/17/02
309	244-U-SY-102	Sat 8/17/02	Sat 8/17/02
310	244-S-SY-102	Thu 8/22/02	Thu 8/22/02
311	244-S-SY-102	Wed 8/28/02	Wed 8/28/02
312	244-CR-AP-108	Sun 9/1/02	Sun 9/1/02
313	244-S-SY-102	Tue 9/3/02	Tue 9/3/02
314	AP-108-AP-107	Tue 9/3/02	Tue 9/3/02
315	244-CR-AP-108	Thu 9/5/02	Thu 9/5/02
316	AP-107-AW-102	Sun 9/8/02	Sun 9/8/02
317	244-S-SY-102	Mon 9/9/02	Mon 9/9/02
318	244-CR-AP-108	Tue 9/10/02	Tue 9/10/02
319	AW-102-242-A	Wed 9/11/02	Wed 9/11/02
320	244-U-SY-102	Sat 9/14/02	Sat 9/14/02
321	244-CR-AP-108	Sun 9/15/02	Sun 9/15/02
322	244-S-SY-102	Mon 9/16/02	Mon 9/16/02
323	244-CR-AP-108	Sun 9/22/02	Sun 9/22/02
324	244-S-SY-102	Mon 9/23/02	Mon 9/23/02
325	244-CR-AP-108	Mon 9/30/02	Mon 9/30/02
326	244-S-SY-102	Mon 9/30/02	Mon 9/30/02
327	244-S-SY-102	Mon 10/7/02	Mon 10/7/02
328	244-CR-AP-108	Sat 10/12/02	Sat 10/12/02

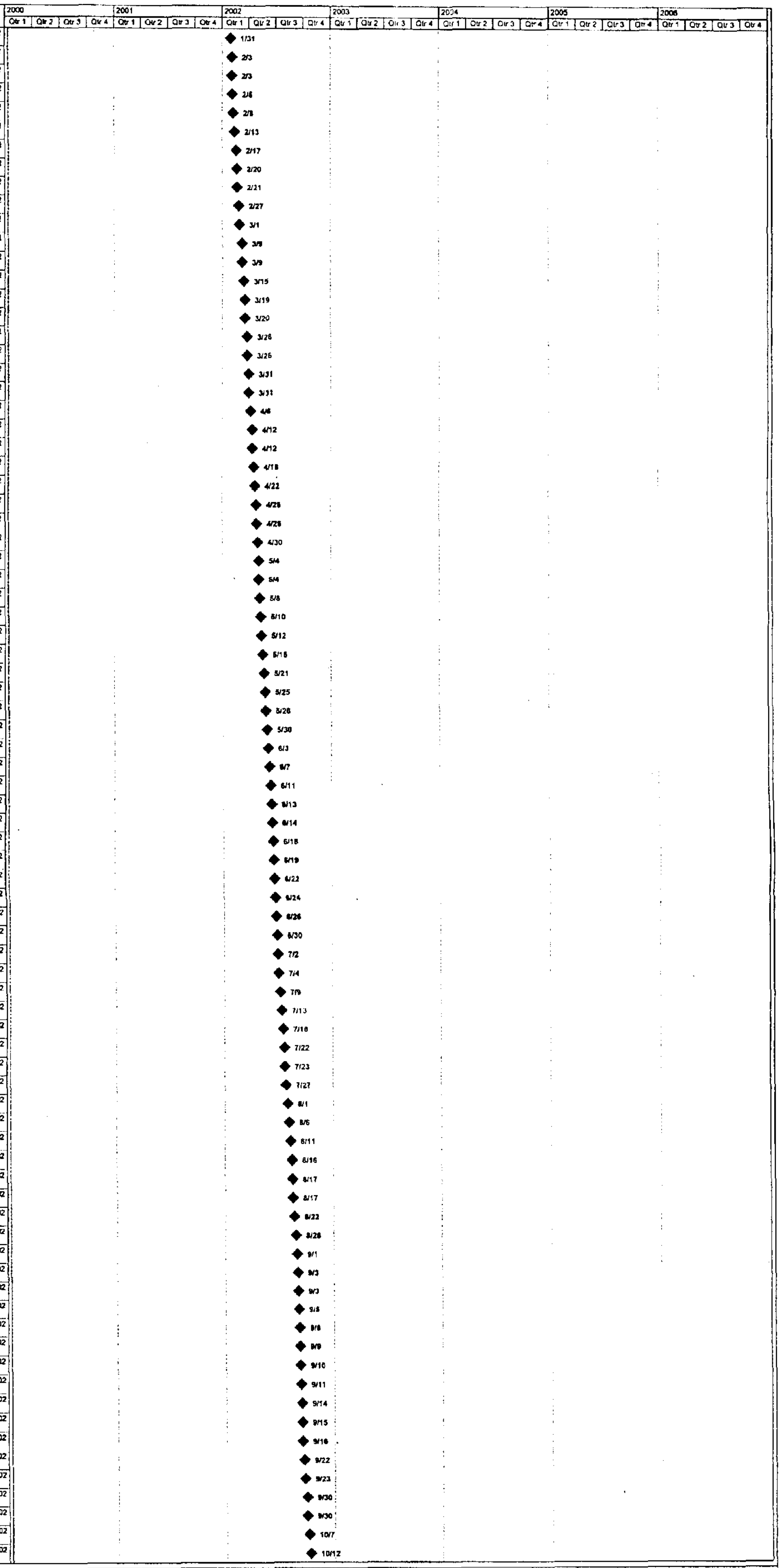

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
329	244-S-SY-102	Tue 10/15/02	Tue 10/15/02
330	244-U-SY-102	Fri 10/18/02	Fri 10/18/02
331	244-S-SY-102	Wed 10/23/02	Wed 10/23/02
332	244-BX-AP-107	Thu 10/31/02	Thu 10/31/02
333	244-S-SY-102	Thu 10/31/02	Thu 10/31/02
334	244-CR-AP-106	Sat 11/2/02	Sat 11/2/02
335	244-S-SY-102	Sat 11/9/02	Sat 11/9/02
336	244-S-SY-102	Mon 11/18/02	Mon 11/18/02
337	244-S-SY-102	Thu 11/28/02	Thu 11/28/02
338	244-U-SY-102	Fri 11/29/02	Fri 11/29/02
339	244-S-SY-102	Mon 12/9/02	Mon 12/9/02
340	244-S-SY-102	Fri 12/20/02	Fri 12/20/02
341	244-CR-AP-106	Tue 12/31/02	Tue 12/31/02
342	244-S-SY-102	Wed 1/1/03	Wed 1/1/03
343	244-S-SY-102	Tue 1/14/03	Tue 1/14/03
344	244-U-SY-102	Wed 1/22/03	Wed 1/22/03
345	244-S-SY-102	Tue 1/28/03	Tue 1/28/03
346	244-S-SY-102	Thu 2/13/03	Thu 2/13/03
347	244-S-SY-102	Tue 3/4/03	Tue 3/4/03
348	AN-101-AP-103	Wed 3/5/03	Wed 3/5/03
349	244-BX-AP-107	Sun 3/9/03	Sun 3/9/03
350	AN-101-AN-106	Thu 3/13/03	Thu 3/13/03
351	AN-101-AN-106	Tue 3/25/03	Tue 3/25/03
352	244-S-SY-102	Thu 3/27/03	Thu 3/27/03
353	244-S-SY-102	Tue 4/22/03	Tue 4/22/03
354	244-U-SY-102	Thu 4/24/03	Thu 4/24/03
355	SY-102-AP-107	Thu 4/24/03	Thu 4/24/03
356	244-BX-AP-107	Sat 5/10/03	Sat 5/10/03
357	AP-107-AW-102	Tue 5/13/03	Tue 5/13/03
358	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
359	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
360	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
361	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
362	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
363	244-S-SY-102	Fri 5/23/03	Fri 5/23/03
364	244-U-SY-102	Wed 5/28/03	Wed 5/28/03
365	244-S-SY-102	Sat 7/12/03	Sat 7/12/03
366	244-S-SY-102	Fri 8/15/03	Fri 8/15/03
367	244-S-SY-102	Sun 8/24/03	Sun 8/24/03
368	AZ-101-OUT-TANK	Sat 10/16/04	Sat 10/16/04
369	AW-106-AP-108	Sat 2/26/05	Sat 2/26/05
370	AN-106-AP-107	Fri 9/2/05	Fri 9/2/05
371	AN-107-AN-106	Mon 9/5/05	Mon 9/5/05
372	AN-107-AN-106	Wed 9/7/05	Wed 9/7/05
373	AP-107-AW-102	Wed 9/7/05	Wed 9/7/05
374	AN-101-AN-107	Fri 9/9/05	Fri 9/9/05
375	AN-104-AN-101	Tue 9/13/05	Tue 9/13/05
376	AP-107-AW-102	Tue 9/13/05	Tue 9/13/05
377	AW-106-AP-107	Sat 9/17/05	Sat 9/17/05
378	AZ-101-OUT-TANK	Sun 12/4/05	Sun 12/4/05
379	AN-106-SPARE-10	Fri 12/9/05	Fri 12/9/05
380	AN-102-AN-106	Tue 12/13/05	Tue 12/13/05
381	AZ-101-OUT-TANK	Sat 1/21/06	Sat 1/21/06
382	AZ-101-OUT-TANK	Sat 3/11/06	Sat 3/11/06
383	AZ-101-OUT-TANK	Fri 4/28/06	Fri 4/28/06
384	AZ-101-OUT-TANK	Sun 5/14/06	Sun 5/14/06
385	AZ-102-OUT-TANK	Thu 6/1/06	Thu 6/1/06
386	AZ-102-OUT-TANK	Mon 6/19/06	Mon 6/19/06
387	AZ-102-OUT-TANK	Fri 7/7/06	Fri 7/7/06
388	AZ-102-OUT-TANK	Tue 7/25/06	Tue 7/25/06
389	AZ-102-OUT-TANK	Sat 8/12/06	Sat 8/12/06
390	AZ-102-OUT-TANK	Wed 8/23/06	Wed 8/23/06
391	AW-103-AY-102	Mon 10/2/06	Mon 10/2/06
392	AY-101-AN-107	Fri 3/2/07	Fri 3/2/07
393	AY-102-OUT-TANK	Sun 4/1/07	Sun 4/1/07
394	AW-103-AY-101	Sat 6/2/07	Sat 6/2/07
395	AY-102-OUT-TANK	Sat 8/18/07	Sat 8/18/07
396	AY-102-OUT-TANK	Fri 1/4/08	Fri 1/4/08
397	AN-101-SPARE-10	Mon 1/7/08	Mon 1/7/08
398	AN-101-AN-107	Wed 1/9/08	Wed 1/9/08
399	AN-102-AN-101	Sun 1/13/08	Sun 1/13/08
400	AY-102-OUT-TANK	Thu 5/22/08	Thu 5/22/08
401	AN-104-SPARE-10	Thu 9/11/08	Thu 9/11/08
402	SY-102-AN-104	Sat 9/13/08	Sat 9/13/08
403	AN-104-AZ-101	Sun 9/14/08	Sun 9/14/08
404	AN-104-AN-107	Tue 9/16/08	Tue 9/16/08
405	AY-102-OUT-TANK	Thu 9/18/08	Thu 9/18/08
406	AN-105-AN-104	Sat 9/20/08	Sat 9/20/08
407	AY-102-OUT-TANK	Fri 1/2/09	Fri 1/2/09
408	AY-101-OUT-TANK	Sun 2/8/09	Sun 2/8/09
409	AN-106-SPARE-10	Tue 6/2/09	Tue 6/2/09
410	AY-101-OUT-TANK	Tue 6/2/09	Tue 6/2/09

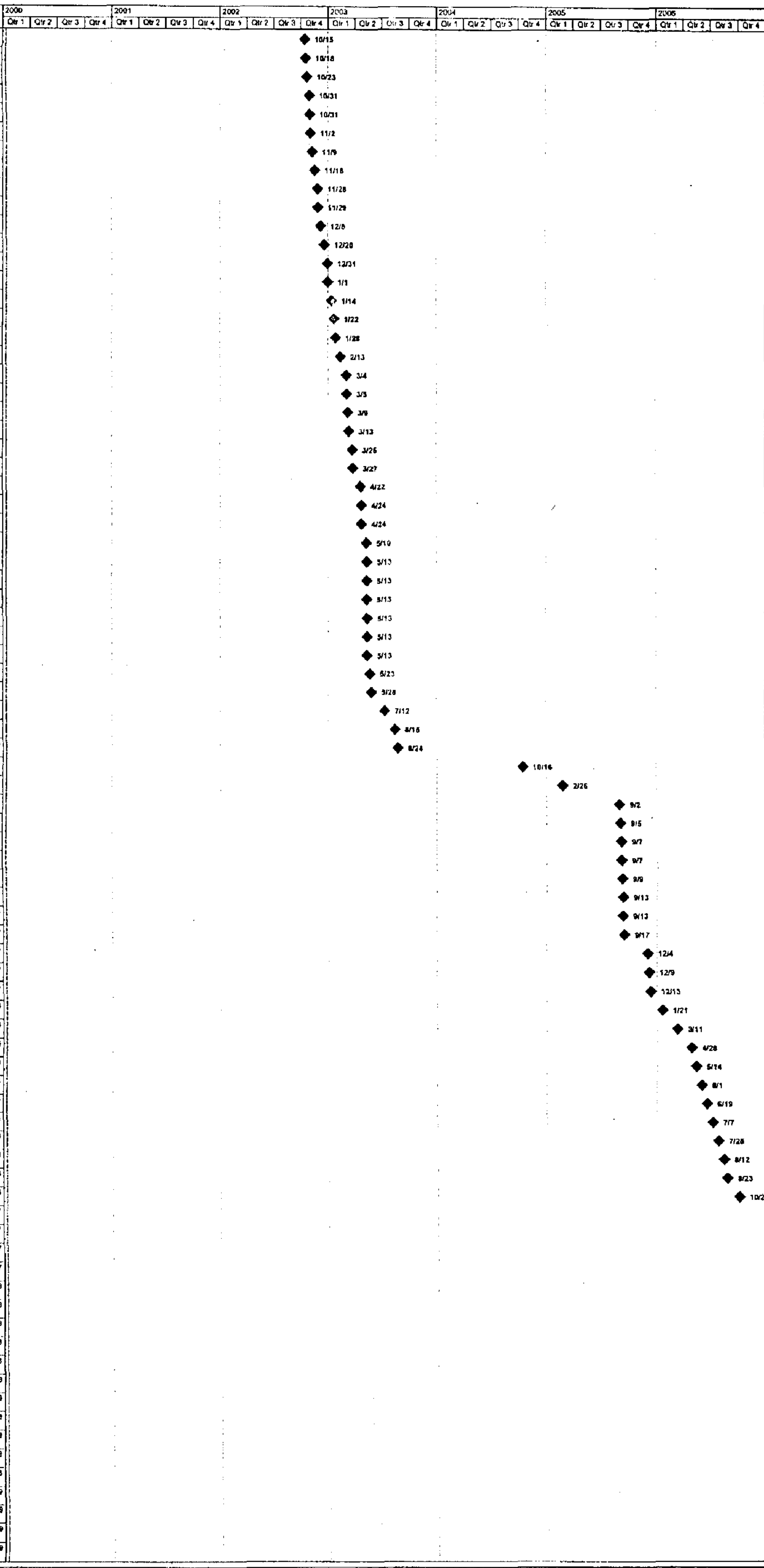

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
329	244-S-SY-102	Tue 10/15/02	Tue 10/15/02
330	244-U-SY-102	Fri 10/18/02	Fri 10/18/02
331	244-S-SY-102	Wed 10/23/02	Wed 10/23/02
332	244-BX-AP-107	Thu 10/31/02	Thu 10/31/02
333	244-S-SY-102	Thu 10/31/02	Thu 10/31/02
334	244-CR-AP-108	Sat 11/2/02	Sat 11/2/02
335	244-S-SY-102	Sat 11/9/02	Sat 11/9/02
336	244-S-SY-102	Mon 11/18/02	Mon 11/18/02
337	244-S-SY-102	Thu 11/28/02	Thu 11/28/02
338	244-U-SY-102	Fri 11/29/02	Fri 11/29/02
339	244-S-SY-102	Mon 12/9/02	Mon 12/9/02
340	244-S-SY-102	Fri 12/20/02	Fri 12/20/02
341	244-CR-AP-108	Tue 12/31/02	Tue 12/31/02
342	244-S-SY-102	Wed 1/1/03	Wed 1/1/03
343	244-S-SY-102	Tue 1/14/03	Tue 1/14/03
344	244-U-SY-102	Wed 1/22/03	Wed 1/22/03
345	244-S-SY-102	Tue 1/28/03	Tue 1/28/03
346	244-S-SY-102	Thu 2/13/03	Thu 2/13/03
347	244-S-SY-102	Tue 3/4/03	Tue 3/4/03
348	AN-101-AP-103	Wed 3/5/03	Wed 3/5/03
349	244-BX-AP-107	Sun 3/9/03	Sun 3/9/03
350	AN-101-AN-106	Thu 3/13/03	Thu 3/13/03
351	AN-101-AN-106	Tue 3/25/03	Tue 3/25/03
352	244-S-SY-102	Thu 3/27/03	Thu 3/27/03
353	244-S-SY-102	Tue 4/22/03	Tue 4/22/03
354	244-U-SY-102	Thu 4/24/03	Thu 4/24/03
355	SY-102-AP-107	Thu 4/24/03	Thu 4/24/03
356	244-BX-AP-107	Sat 5/10/03	Sat 5/10/03
357	AP-107-AW-102	Tue 5/13/03	Tue 5/13/03
358	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
359	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
360	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
361	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
362	AW-102-242-A	Tue 5/13/03	Tue 5/13/03
363	244-S-SY-102	Fri 5/23/03	Fri 5/23/03
364	244-U-SY-102	Wed 5/28/03	Wed 5/28/03
365	244-S-SY-102	Sat 7/12/03	Sat 7/12/03
366	244-S-SY-102	Fri 8/15/03	Fri 8/15/03
367	244-S-SY-102	Sun 8/24/03	Sun 8/24/03
368	AZ-101-OUT-TANK	Sat 10/16/04	Sat 10/16/04
369	AW-106-AP-108	Sat 2/26/05	Sat 2/26/05
370	AN-106-AP-107	Fri 9/2/05	Fri 9/2/05
371	AN-107-AN-106	Mon 9/5/05	Mon 9/5/05
372	AN-107-AN-106	Wed 9/7/05	Wed 9/7/05
373	AP-107-AW-102	Wed 9/7/05	Wed 9/7/05
374	AN-101-AN-107	Fri 9/9/05	Fri 9/9/05
375	AN-104-AN-101	Tue 9/13/05	Tue 9/13/05
376	AP-107-AW-102	Tue 9/13/05	Tue 9/13/05
377	AW-106-AP-107	Sat 9/17/05	Sat 9/17/05
378	AZ-101-OUT-TANK	Sun 12/4/05	Sun 12/4/05
379	AN-106-SPARE-10	Fri 12/9/05	Fri 12/9/05
380	AN-102-AN-106	Tue 12/13/05	Tue 12/13/05
381	AZ-101-OUT-TANK	Sat 1/21/06	Sat 1/21/06
382	AZ-101-OUT-TANK	Sat 3/11/06	Sat 3/11/06
383	AZ-101-OUT-TANK	Fri 4/28/06	Fri 4/28/06
384	AZ-101-OUT-TANK	Sun 5/14/06	Sun 5/14/06
385	AZ-102-OUT-TANK	Thu 6/1/06	Thu 6/1/06
386	AZ-102-OUT-TANK	Mon 6/19/06	Mon 6/19/06
387	AZ-102-OUT-TANK	Fri 7/7/06	Fri 7/7/06
388	AZ-102-OUT-TANK	Tue 7/25/06	Tue 7/25/06
389	AZ-102-OUT-TANK	Sat 8/12/06	Sat 8/12/06
390	AZ-102-OUT-TANK	Wed 8/23/06	Wed 8/23/06
391	AW-103-AY-102	Mon 10/2/06	Mon 10/2/06
392	AY-101-AN-107	Fri 3/2/07	Fri 3/2/07
393	AY-102-OUT-TANK	Sun 4/1/07	Sun 4/1/07
394	AW-103-AY-101	Sat 6/2/07	Sat 6/2/07
395	AY-102-OUT-TANK	Sat 8/18/07	Sat 8/18/07
396	AY-102-OUT-TANK	Fri 1/4/08	Fri 1/4/08
397	AN-101-SPARE-10	Mon 1/7/08	Mon 1/7/08
398	AN-101-AN-107	Wed 1/9/08	Wed 1/9/08
399	AN-102-AN-101	Sun 1/13/08	Sun 1/13/08
400	AY-102-OUT-TANK	Thu 5/22/08	Thu 5/22/08
401	AN-104-SPARE-10	Thu 9/11/08	Thu 9/11/08
402	SY-102-AN-104	Sat 9/13/08	Sat 9/13/08
403	AN-104-AZ-101	Sun 9/14/08	Sun 9/14/08
404	AN-104-AN-107	Tue 9/16/08	Tue 9/16/08
405	AY-102-OUT-TANK	Thu 9/18/08	Thu 9/18/08
406	AN-105-AN-104	Sat 9/20/08	Sat 9/20/08
407	AY-102-OUT-TANK	Fri 1/2/09	Fri 1/2/09
408	AY-101-OUT-TANK	Sun 2/8/09	Sun 2/8/09
409	AN-106-SPARE-10	Tue 6/2/09	Tue 6/2/09
410	AY-101-OUT-TANK	Tue 6/2/09	Tue 6/2/09

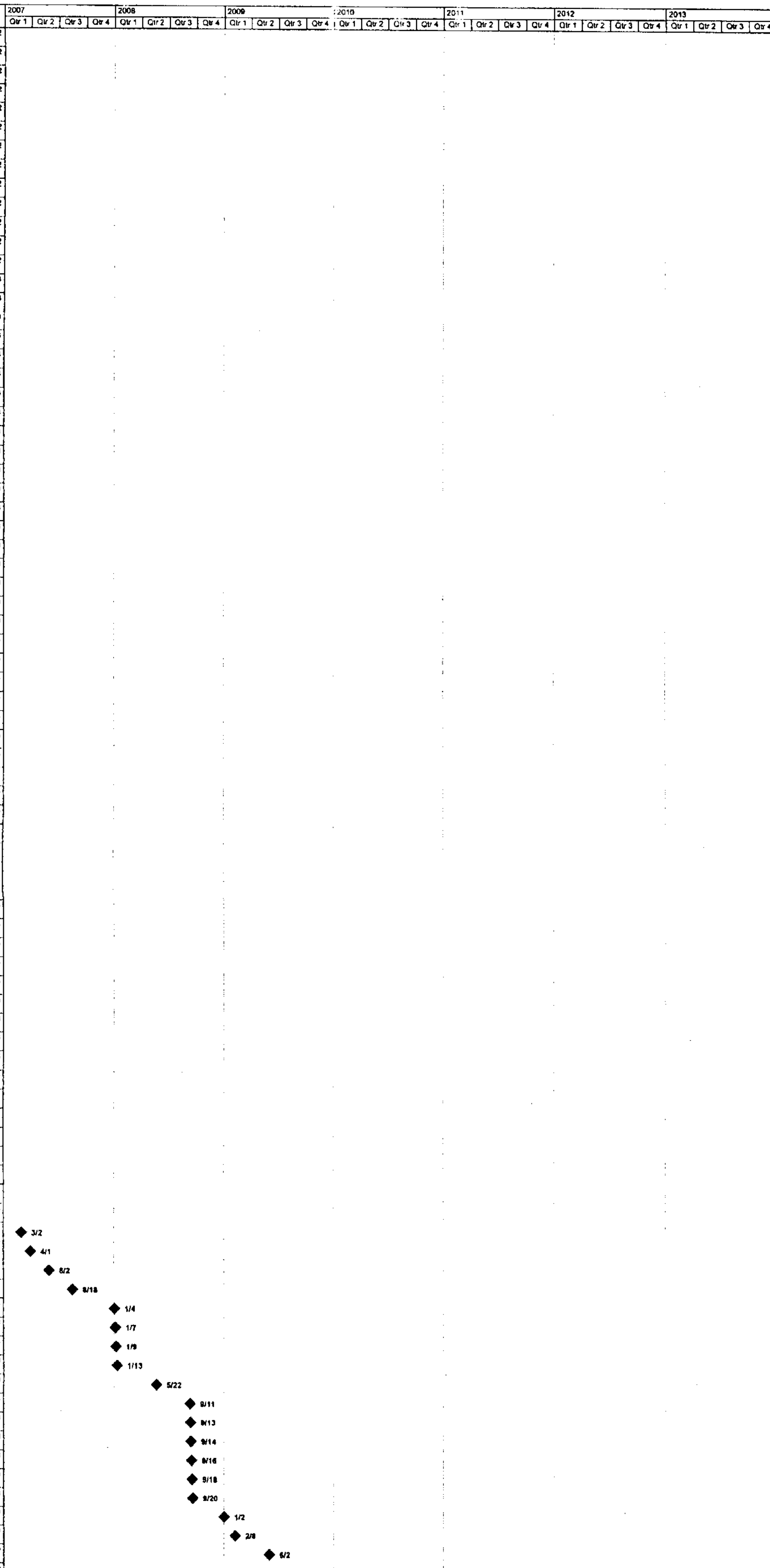

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
411	AN-106-AN-107	Wed 6/3/09	Wed 6/3/09
412	AP-106-AN-106	Sun 6/7/09	Sun 6/7/09
413	AY-101-OUT-TANK	Wed 9/23/09	Wed 9/23/09
414	AW-103-AZ-101	Sun 1/3/10	Sun 1/3/10
415	AY-101-OUT-TANK	Thu 1/14/10	Thu 1/14/10
416	AN-101-SPARE-10	Thu 2/11/10	Thu 2/11/10
417	SY-101-SY-102	Mon 2/15/10	Mon 2/15/10
418	SY-102-AN-101	Wed 2/17/10	Wed 2/17/10
419	AY-101-OUT-TANK	Sat 5/8/10	Sat 5/8/10
420	AN-104-SPARE-10	Mon 8/23/10	Mon 8/23/10
421	AY-101-OUT-TANK	Sun 8/29/10	Sun 8/29/10
422	AY-101-OUT-TANK	Tue 12/21/10	Tue 12/21/10
423	AN-105-SPARE-10	Wed 2/16/11	Wed 2/16/11
424	AN-103-AN-105	Sun 2/20/11	Sun 2/20/11
425	AN-104-AP-102	Fri 3/26/11	Fri 3/25/11
426	SY-102-AN-104	Fri 3/25/11	Fri 3/25/11
427	AN-104-AP-106	Wed 3/30/11	Wed 3/30/11
428	AY-101-OUT-TANK	Sun 4/10/11	Sun 4/10/11
429	SY-102-AN-104	Sat 5/21/11	Sat 5/21/11
430	AN-104-AP-106	Sun 5/22/11	Sun 5/22/11
431	AN-104-AW-103	Thu 5/26/11	Thu 5/26/11
432	SY-102-AN-104	Sat 7/2/11	Sat 7/2/11
433	AN-104-AW-103	Sun 7/3/11	Sun 7/3/11
434	AZ-101-OUT-TANK	Mon 7/4/11	Mon 7/4/11
435	AN-106-SPARE-10	Mon 8/15/11	Mon 8/15/11
436	AN-106-AN-107	Tue 8/16/11	Tue 8/16/11
437	AN-106-AN-107	Thu 8/18/11	Thu 8/18/11
438	AN-107-AW-102	Thu 8/18/11	Thu 8/18/11
439	AW-101-AN-106	Tue 8/23/11	Tue 8/23/11
440	AP-102-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
441	AP-103-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
442	AP-106-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
443	AP-108-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
444	AW-103-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
445	AW-103-OUT-OF-T	Mon 10/3/11	Mon 10/3/11
446	AN-101-SPARE-10	Wed 1/4/12	Wed 1/4/12
447	AN-101-AN-107	Fri 1/6/12	Fri 1/6/12
448	AW-101-AN-101	Tue 1/10/12	Tue 1/10/12
449	AZ-101-OUT-TANK	Sun 1/15/12	Sun 1/15/12
450	AN-105-SPARE-10	Wed 4/18/12	Wed 4/18/12
451	AN-105-AN-107	Thu 4/19/12	Thu 4/19/12
452	AN-105-AN-107	Tue 4/24/12	Tue 4/24/12
453	AN-107-AW-102	Tue 4/24/12	Tue 4/24/12
454	AW-106-AW-102	Fri 4/27/12	Fri 4/27/12
455	AW-104-AN-105	Sat 4/28/12	Sat 4/28/12
456	AW-106-AW-102	Wed 5/2/12	Wed 5/2/12
457	AW-106-AP-107	Mon 5/7/12	Mon 5/7/12
458	AW-104-AY-102	Mon 7/16/12	Mon 7/16/12
459	AZ-101-OUT-TANK	Sat 7/28/12	Sat 7/28/12
460	AN-103-SPARE-10	Wed 10/24/12	Wed 10/24/12
461	AN-104-AN-103	Sun 10/28/12	Sun 10/28/12
462	SY-101-AN-104	Thu 11/1/12	Thu 11/1/12
463	AZ-101-OUT-TANK	Sat 2/9/13	Sat 2/9/13
464	AN-106-SPARE-10	Tue 6/18/13	Tue 6/18/13
465	AN-106-AN-107	Thu 6/20/13	Thu 6/20/13
466	AP-105-AN-106	Mon 6/24/13	Mon 6/24/13
467	AZ-101-OUT-TANK	Sat 8/24/13	Sat 8/24/13
468	AZ-101-OUT-TANK	Sun 3/2/14	Sun 3/2/14
469	AW-104-AZ-102	Sat 6/21/14	Sat 6/21/14
470	AN-101-SPARE-10	Thu 6/26/14	Thu 6/26/14
471	AN-104-AW-104	Thu 6/26/14	Thu 6/26/14
472	AN-101-AN-107	Fri 6/27/14	Fri 6/27/14
473	AY-102-OUT-TANK	Sat 6/28/14	Sat 6/28/14
474	AP-105-AN-101	Wed 7/2/14	Wed 7/2/14
475	AP-105-AN-101	Wed 7/2/14	Wed 7/2/14
476	AN-104-AP-105	Sat 7/5/14	Sat 7/5/14
477	SY-102-AN-104	Wed 7/9/14	Wed 7/9/14
478	AN-104-AP-105	Thu 7/10/14	Thu 7/10/14
479	AY-102-OUT-TANK	Mon 9/15/14	Mon 9/15/14
480	AY-102-OUT-TANK	Wed 12/3/14	Wed 12/3/14
481	AN-105-SPARE-10	Thu 12/18/14	Thu 12/18/14
482	AP-104-AN-105	Sun 12/21/14	Sun 12/21/14
483	AP-104-AN-105	Sun 12/21/14	Sun 12/21/14
484	AY-102-OUT-TANK	Thu 2/19/15	Thu 2/19/15
485	AY-102-OUT-TANK	Sat 5/9/15	Sat 5/9/15
486	AN-106-SPARE-10	Fri 5/29/15	Fri 5/29/15
487	AP-104-AN-106	Tue 6/2/15	Tue 6/2/15
488	AP-104-AN-106	Tue 6/2/15	Tue 6/2/15
489	AN-104-AP-104	Fri 6/5/15	Fri 6/5/15
490	SY-101-AN-104	Tue 6/9/15	Tue 6/9/15
491	AY-102-OUT-TANK	Mon 7/27/15	Mon 7/27/15
492	AY-102-OUT-TANK	Mon 10/12/15	Mon 10/12/15

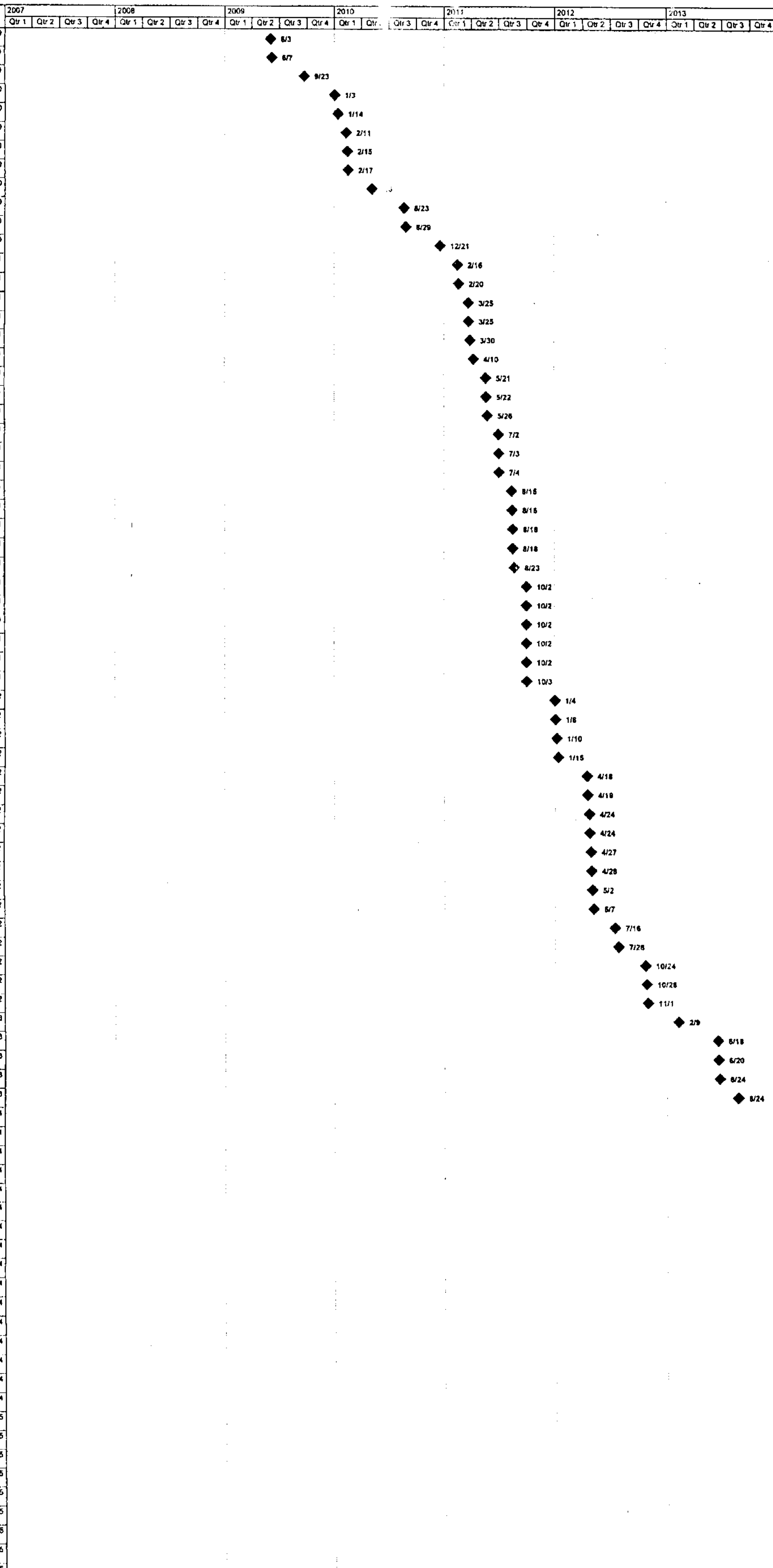

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
411	AN-106-AN-107	Wed 6/3/09	Wed 6/3/09
412	AP-108-AN-106	Sun 6/7/09	Sun 6/7/09
413	AY-101-OUT-TANK	Wed 9/23/09	Wed 9/23/09
414	AW-103-AZ-101	Sun 1/3/10	Sun 1/3/10
415	AY-101-OUT-TANK	Thu 1/14/10	Thu 1/14/10
416	AN-101-SPARE-10	Thu 2/11/10	Thu 2/11/10
417	SY-101-SY-102	Mon 2/15/10	Mon 2/15/10
418	SY-102-AN-101	Wed 2/17/10	Wed 2/17/10
419	AY-101-OUT-TANK	Sat 5/8/10	Sat 5/8/10
420	AN-104-SPARE-10	Mon 8/23/10	Mon 8/23/10
421	AY-101-OUT-TANK	Sun 8/29/10	Sun 8/29/10
422	AY-101-OUT-TANK	Tue 12/21/10	Tue 12/21/10
423	AN-105-SPARE-10	Wed 2/16/11	Wed 2/16/11
424	AN-103-AN-105	Sun 2/20/11	Sun 2/20/11
425	AN-104-AP-102	Fri 3/25/11	Fri 3/25/11
426	SY-102-AN-104	Fri 3/25/11	Fri 3/25/11
427	AN-104-AP-108	Wed 3/30/11	Wed 3/30/11
428	AY-101-OUT-TANK	Sun 4/10/11	Sun 4/10/11
429	SY-102-AN-104	Sat 5/21/11	Sat 5/21/11
430	AN-104-AP-108	Sun 5/22/11	Sun 5/22/11
431	AN-104-AW-103	Thu 5/26/11	Thu 5/26/11
432	SY-102-AN-104	Sat 7/2/11	Sat 7/2/11
433	AN-104-AW-103	Sun 7/3/11	Sun 7/3/11
434	AZ-101-OUT-TANK	Mon 7/4/11	Mon 7/4/11
435	AN-106-SPARE-10	Mon 8/15/11	Mon 8/15/11
436	AN-106-AN-107	Tue 8/16/11	Tue 8/16/11
437	AN-106-AN-107	Thu 8/18/11	Thu 8/18/11
438	AN-107-AW-102	Thu 8/18/11	Thu 8/18/11
439	AW-101-AN-106	Tue 8/23/11	Tue 8/23/11
440	AP-102-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
441	AP-103-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
442	AP-106-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
443	AP-108-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
444	AW-103-OUT-OF-T	Sun 10/2/11	Sun 10/2/11
445	AW-103-OUT-OF-T	Mon 10/3/11	Mon 10/3/11
446	AN-101-SPARE-10	Wed 1/4/12	Wed 1/4/12
447	AN-101-AN-107	Fri 1/6/12	Fri 1/6/12
448	AW-101-AN-101	Tue 1/10/12	Tue 1/10/12
449	AZ-101-OUT-TANK	Sun 1/15/12	Sun 1/15/12
450	AN-105-SPARE-10	Wed 4/18/12	Wed 4/18/12
451	AN-106-AN-107	Thu 4/19/12	Thu 4/19/12
452	AN-105-AN-107	Tue 4/24/12	Tue 4/24/12
453	AN-107-AW-102	Tue 4/24/12	Tue 4/24/12
454	AW-106-AW-102	Fri 4/27/12	Fri 4/27/12
455	AW-104-AN-106	Sat 4/28/12	Sat 4/28/12
456	AW-106-AW-102	Wed 5/2/12	Wed 5/2/12
457	AW-106-AP-107	Mon 5/7/12	Mon 5/7/12
458	AW-104-AY-102	Mon 7/16/12	Mon 7/16/12
459	AZ-101-OUT-TANK	Sat 7/28/12	Sat 7/28/12
460	AN-103-SPARE-10	Wed 10/24/12	Wed 10/24/12
461	AN-104-AN-103	Sun 10/28/12	Sun 10/28/12
462	SY-101-AN-104	Thu 11/1/12	Thu 11/1/12
463	AZ-101-OUT-TANK	Sat 2/9/13	Sat 2/9/13
464	AN-106-SPARE-10	Tue 6/18/13	Tue 6/18/13
465	AN-106-AN-107	Thu 6/20/13	Thu 6/20/13
466	AP-105-AN-106	Mon 6/24/13	Mon 6/24/13
467	AZ-101-OUT-TANK	Sat 8/24/13	Sat 8/24/13
468	AZ-101-OUT-TANK	Sun 3/2/14	Sun 3/2/14
469	AW-104-AZ-102	Sat 6/21/14	Sat 6/21/14
470	AN-101-SPARE-10	Thu 6/26/14	Thu 6/26/14
471	AN-104-AW-104	Thu 6/26/14	Thu 6/26/14
472	AN-101-AN-107	Fri 6/27/14	Fri 6/27/14
473	AY-102-OUT-TANK	Sat 6/28/14	Sat 6/28/14
474	AP-105-AN-101	Wed 7/2/14	Wed 7/2/14
475	AP-105-AN-101	Wed 7/2/14	Wed 7/2/14
476	AN-104-AP-105	Sat 7/5/14	Sat 7/5/14
477	SY-102-AN-104	Wed 7/9/14	Wed 7/9/14
478	AN-104-AP-105	Thu 7/10/14	Thu 7/10/14
479	AY-102-OUT-TANK	Mon 9/15/14	Mon 9/15/14
480	AY-102-OUT-TANK	Wed 12/3/14	Wed 12/3/14
481	AN-105-SPARE-10	Thu 12/18/14	Thu 12/18/14
482	AP-104-AN-105	Sun 12/21/14	Sun 12/21/14
483	AP-104-AN-105	Sun 12/21/14	Sun 12/21/14
484	AY-102-OUT-TANK	Thu 2/19/15	Thu 2/19/15
485	AY-102-OUT-TANK	Sat 5/9/15	Sat 5/9/15
486	AN-106-SPARE-10	Fri 5/29/15	Fri 5/29/15
487	AP-104-AN-106	Tue 6/2/15	Tue 6/2/15
488	AP-104-AN-106	Tue 6/2/15	Tue 6/2/15
489	AN-104-AP-104	Fri 6/5/15	Fri 6/5/15
490	SY-101-AN-104	Tue 6/9/15	Tue 6/9/15
491	AY-102-OUT-TANK	Mon 7/27/15	Mon 7/27/15
492	AY-102-OUT-TANK	Mon 10/12/15	Mon 10/12/15

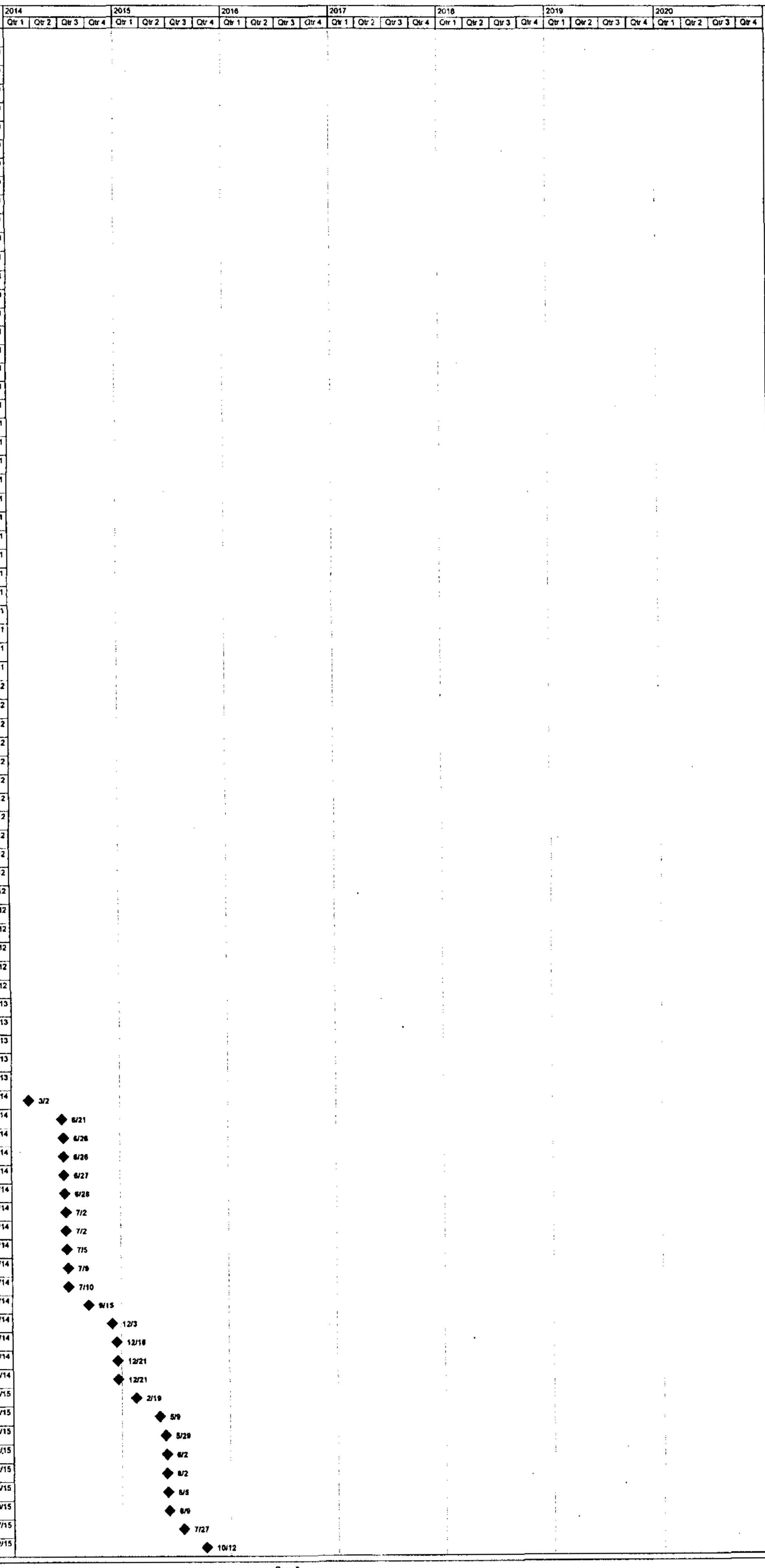

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
493	AW-105-AY-101	Sun 12/6/15	Sun 12/6/15
494	AN-101-SPARE-10	Thu 12/10/15	Thu 12/10/15
495	AZ-102-OUT-TANK	Sat 12/12/15	Sat 12/12/15
496	AP-101-AN-101	Mon 12/14/15	Mon 12/14/15
497	AP-101-AN-101	Mon 12/14/15	Mon 12/14/15
498	AZ-102-OUT-TANK	Mon 2/29/16	Mon 2/29/16
499	AZ-102-OUT-TANK	Wed 5/18/16	Wed 5/18/16
500	AN-105-SPARE-10	Tue 6/21/16	Tue 6/21/16
501	AP-101-AN-105	Sat 6/25/16	Sat 6/25/16
502	AP-101-AN-105	Sat 6/25/16	Sat 6/25/16
503	AN-104-AP-101	Fri 7/1/16	Fri 7/1/16
504	AZ-102-OUT-TANK	Thu 8/4/16	Thu 8/4/16
505	AZ-102-OUT-TANK	Sat 10/22/16	Sat 10/22/16
506	AN-106-SPARE-10	Wed 12/7/16	Wed 12/7/16
507	AN-104-AN-106	Sat 12/10/16	Sat 12/10/16
508	SY-102-AN-104	Tue 12/13/16	Tue 12/13/16
509	AZ-102-OUT-TANK	Mon 1/9/17	Mon 1/9/17
510	AZ-102-OUT-TANK	Tue 3/28/17	Tue 3/28/17
511	AN-101-SPARE-10	Fri 5/26/17	Fri 5/26/17
512	AN-104-AN-101	Thu 6/1/17	Thu 6/1/17
513	AZ-102-OUT-TANK	Wed 6/7/17	Wed 6/7/17
514	AN-104-AW-105	Sun 6/25/17	Sun 6/25/17
515	AW-105-AZ-101	Sun 6/25/17	Sun 6/25/17
516	SY-101-AN-104	Wed 6/28/17	Wed 6/28/17
517	AY-102-AW-105	Fri 6/30/17	Fri 6/30/17
518	AY-101-OUT-TANK	Fri 7/7/17	Fri 7/7/17
519	AY-101-OUT-TANK	Thu 10/12/17	Thu 10/12/17
520	AN-105-SPARE-10	Thu 11/16/17	Thu 11/16/17
521	AY-102-AN-106	Fri 11/17/17	Fri 11/17/17
522	AN-104-AN-106	Tue 11/21/17	Tue 11/21/17
523	AY-101-OUT-TANK	Thu 1/18/18	Thu 1/18/18
524	AY-101-OUT-TANK	Wed 4/25/18	Wed 4/25/18
525	AN-104-AW-106	Mon 5/7/18	Mon 5/7/18
526	AN-104-AW-102	Mon 5/7/18	Mon 5/7/18
527	AY-102-AN-107	Tue 5/8/18	Tue 5/8/18
528	AY-102-AW-102	Thu 5/10/18	Thu 5/10/18
529	AY-102-AN-102	Fri 5/11/18	Fri 5/11/18
530	SY-102-AN-104	Fri 5/11/18	Fri 5/11/18
531	AN-104-AN-102	Tue 5/15/18	Tue 5/15/18
532	AP-105-OUT-OF-T	Sat 6/30/18	Sat 6/30/18
533	AW-104-OUT-OF-T	Mon 7/2/18	Mon 7/2/18
534	AP-105-OUT-OF-T	Sun 7/29/18	Sun 7/29/18
535	AY-101-OUT-TANK	Tue 7/31/18	Tue 7/31/18
536	AW-104-OUT-OF-T	Fri 8/24/18	Fri 8/24/18
537	AP-106-OUT-OF-T	Tue 9/18/18	Tue 9/18/18
538	AW-104-OUT-OF-T	Thu 9/20/18	Thu 9/20/18
539	AY-101-OUT-TANK	Thu 10/25/18	Thu 10/25/18
540	AP-104-OUT-OF-T	Mon 11/5/18	Mon 11/5/18
541	AN-103-OUT-OF-T	Fri 11/9/18	Fri 11/9/18
542	AN-102-OUT-OF-T	Sat 12/1/18	Sat 12/1/18
543	AZ-101-OUT-TANK	Thu 12/6/18	Thu 12/6/18
544	AN-101-OUT-OF-T	Thu 2/28/19	Thu 2/28/19
545	AP-106-OUT-OF-T	Mon 3/4/19	Mon 3/4/19
546	AZ-101-OUT-TANK	Fri 3/15/19	Fri 3/15/19
547	AP-104-OUT-OF-T	Sun 3/17/19	Sun 3/17/19
548	AN-103-OUT-OF-T	Wed 4/10/19	Wed 4/10/19
549	AN-102-OUT-OF-T	Fri 4/12/19	Fri 4/12/19
550	AW-104-OUT-OF-T	Wed 4/17/19	Wed 4/17/19
551	AN-101-OUT-OF-T	Sun 5/12/19	Sun 5/12/19
552	AN-102-OUT-OF-T	Wed 5/15/19	Wed 5/15/19
553	AN-107-OUT-OF-T	Tue 6/11/19	Tue 6/11/19
554	AZ-101-OUT-TANK	Fri 6/21/19	Fri 6/21/19
555	AN-103-OUT-OF-T	Sat 6/29/19	Sat 6/29/19
556	AZ-102-HLW_RET	Thu 9/5/19	Thu 9/5/19
557	AZ-102-PHASE2_H	Thu 9/5/19	Thu 9/5/19
558	AP-104-OUT-OF-T	Fri 9/6/19	Fri 9/6/19
559	AW-103-OUT-OF-T	Sun 9/8/19	Sun 9/8/19
560	AN-106-OUT-OF-T	Mon 9/9/19	Mon 9/9/19
561	AN-101-OUT-OF-T	Tue 9/10/19	Tue 9/10/19
562	AN-107-OUT-OF-T	Wed 9/11/19	Wed 9/11/19
563	AZ-101-OUT-TANK	Sat 9/28/19	Sat 9/28/19
564	AW-106-OUT-OF-T	Thu 10/3/19	Thu 10/3/19
565	AP-106-OUT-OF-T	Tue 10/8/19	Tue 10/8/19
566	AN-103-OUT-OF-T	Mon 10/28/19	Mon 10/28/19
567	AN-102-OUT-OF-T	Sun 11/3/19	Sun 11/3/19
568	AP-105-OUT-OF-T	Tue 11/12/19	Tue 11/12/19
569	AW-104-OUT-OF-T	Fri 12/6/19	Fri 12/6/19
570	AN-106-OUT-OF-T	Fri 12/20/19	Fri 12/20/19
571	AW-106-OUT-OF-T	Sun 12/29/19	Sun 12/29/19
572	AZ-101-OUT-TANK	Sat 1/4/20	Sat 1/4/20
573	AP-104-OUT-OF-T	Wed 1/8/20	Wed 1/8/20
574	AZ-102-PHASE2_H	Sat 1/11/20	Sat 1/11/20

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Figure A-2. Double-Shell Tank Transfer Line Flushes. (10 Sheets)

ID	Task Name	Start	Finish
575	AP-106-OUT-OF-T	Mon 1/13/20	Mon 1/13/20
576	AP-101-OUT-OF-T	Fri 2/7/20	Fri 2/7/20
577	AN-107-OUT-OF-T	Sun 3/8/20	Sun 3/8/20
578	AW-103-OUT-OF-T	Fri 3/27/20	Fri 3/27/20
579	AZ-101-OUT-TANK	Wed 4/1/20	Wed 4/1/20
580	AN-101-OUT-OF-T	Fri 5/22/20	Fri 5/22/20
581	AW-106-OUT-OF-T	Wed 6/10/20	Wed 6/10/20
582	AN-106-OUT-OF-T	Wed 6/24/20	Wed 6/24/20
583	AN-102-OUT-OF-T	Sat 6/27/20	Sat 6/27/20
584	AN-103-OUT-OF-T	Sat 7/11/20	Sat 7/11/20
585	AP-101-OUT-OF-T	Tue 8/4/20	Tue 8/4/20
586	AN-105-OUT-OF-T	Mon 8/24/20	Mon 8/24/20
587	AN-107-OUT-OF-T	Sat 8/29/20	Sat 8/29/20
588	AP-104-OUT-OF-T	Thu 9/10/20	Thu 9/10/20
589	AP-106-OUT-OF-T	Tue 9/22/20	Tue 9/22/20
590	AW-106-OUT-OF-T	Fri 10/2/20	Fri 10/2/20
591	AW-102-OUT-OF-T	Sat 10/17/20	Sat 10/17/20
592	AP-101-OUT-OF-T	Wed 10/21/20	Wed 10/21/20
593	AN-105-OUT-OF-T	Sat 11/7/20	Sat 11/7/20
594	AN-101-OUT-OF-T	Thu 11/12/20	Thu 11/12/20
595	AW-104-OUT-OF-T	Sun 11/15/20	Sun 11/15/20
596	AW-106-OUT-OF-T	Wed 11/25/20	Wed 11/25/20
597	AN-106-OUT-OF-T	Fri 12/4/20	Fri 12/4/20
598	AW-103-OUT-OF-T	Tue 12/15/20	Tue 12/15/20

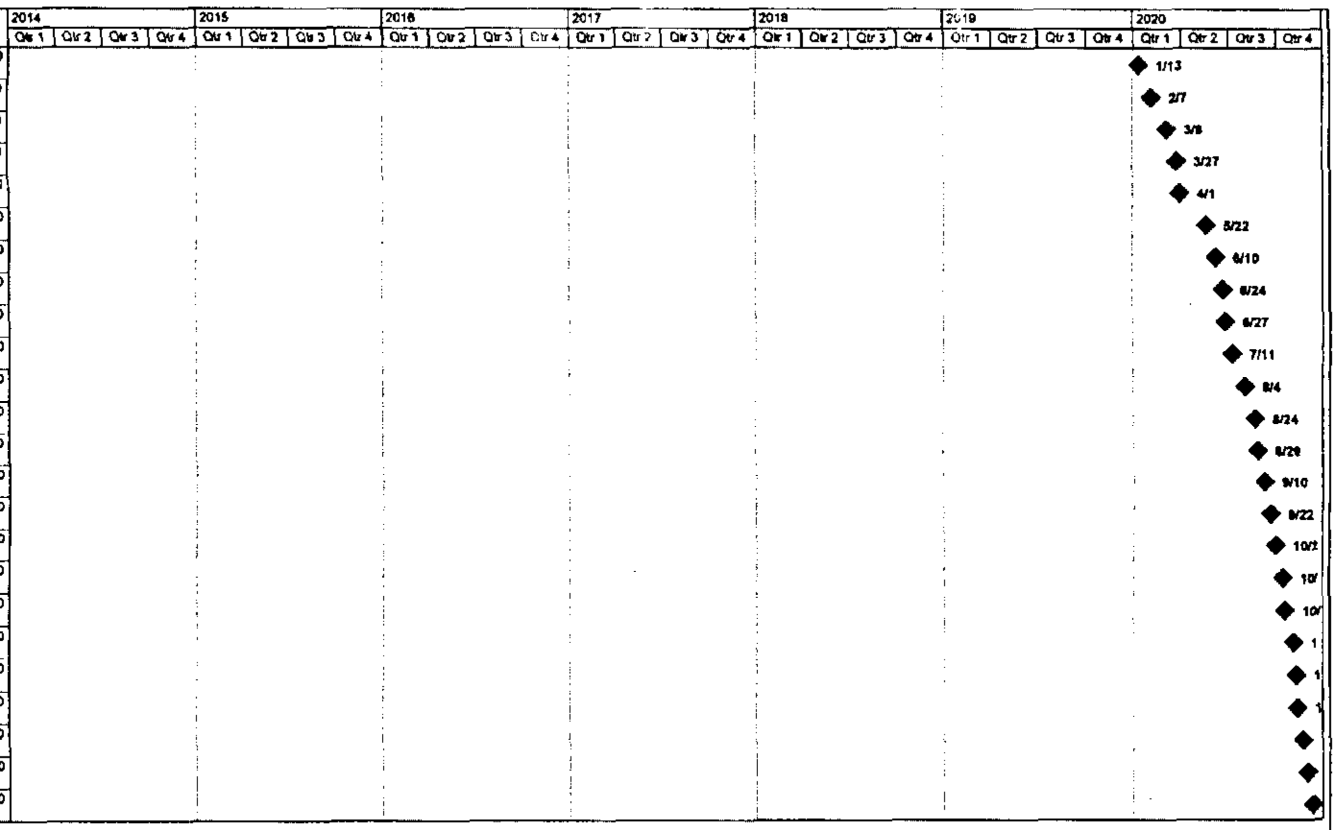

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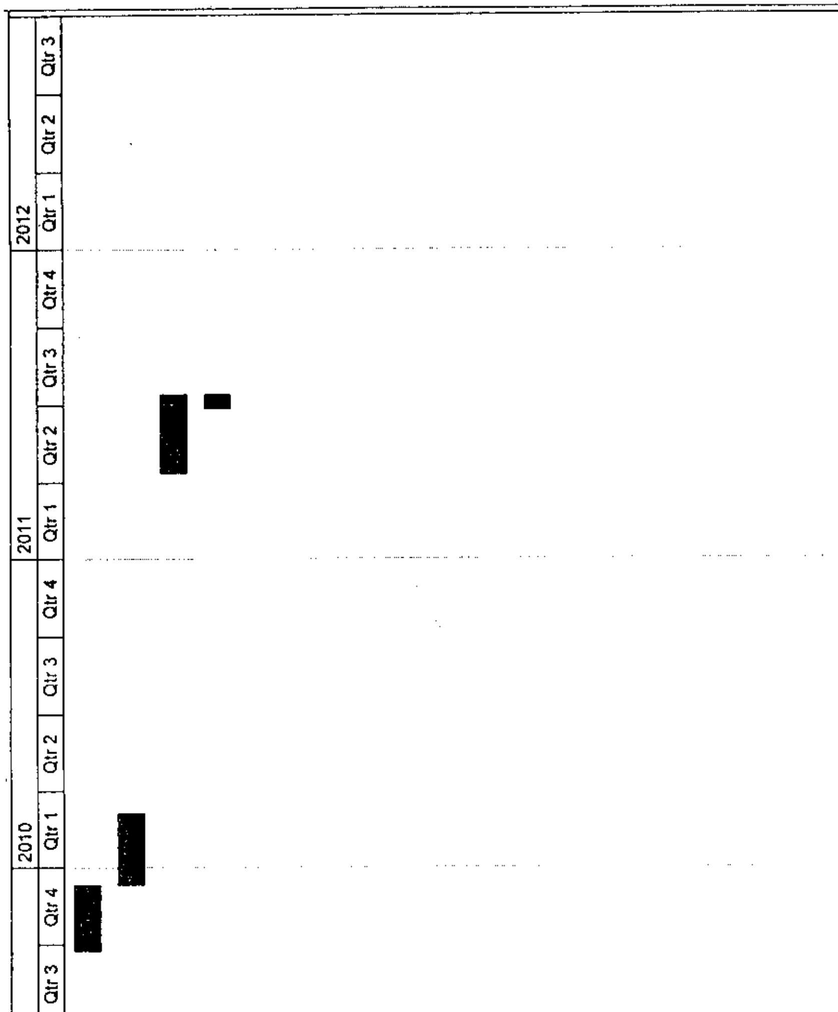
Figure A-3. Single-Shell Tank to Double-Shell Tank Retrieval Activities. (3 Sheets)

ID		Task Name	Start	Finish
9		C-104-AY-102	Wed 9/23/09	Fri 12/11/09
10		C-104-AZ-102	Fri 12/11/09	Sun 3/7/10
16		S-112-SY-101	Tue 4/12/11	Thu 7/14/11
11		S-102-SY-101	Mon 6/27/11	Thu 7/14/11
12		S-102-SY-101	Thu 11/1/12	Mon 3/4/13
17		S-112-SY-101	Thu 11/1/12	Mon 3/4/13
7		C-102-AY-101	Mon 9/15/14	Sat 12/6/14
8		C-102-AZ-101	Mon 12/15/14	Sat 3/7/15
13		S-102-SY-101	Tue 6/9/15	Sun 9/13/15
18		S-112-SY-101	Tue 6/9/15	Sun 9/13/15
1		A-101-AY-102	Tue 7/26/16	Tue 2/14/17
4		AX-101-AY-102	Fri 1/6/17	Tue 2/14/17
14		S-102-SY-101	Wed 6/28/17	Mon 9/25/17
15		S-103-SY-101	Wed 6/28/17	Mon 9/25/17
2		A-101-AY-102	Fri 11/17/17	Wed 3/14/18
5		AX-101-AY-102	Fri 11/17/17	Wed 3/14/18
3		A-101-AY-102	Fri 5/11/18	Wed 9/5/18
6		AX-101-AY-102	Fri 5/11/18	Wed 9/5/18



Project: sstsluic
Date: Tue 1/11/00

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

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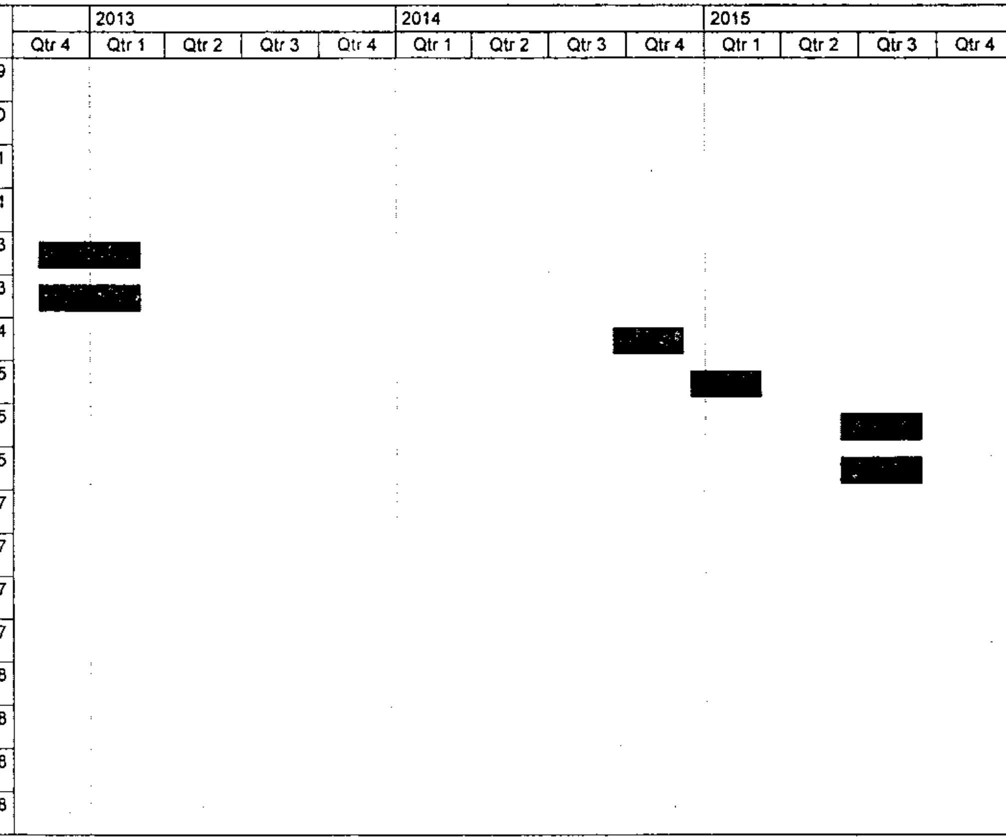
Figure A-3. Single-Shell Tank to Double-Shell Tank Retrieval Activities. (3 Sheets)

ID	Task Name	Start	Finish
9	C-104-AY-102	Wed 9/23/09	Fri 12/11/09
10	C-104-AZ-102	Fri 12/11/09	Sun 3/7/10
16	S-112-SY-101	Tue 4/12/11	Thu 7/14/11
11	S-102-SY-101	Mon 6/27/11	Thu 7/14/11
12	S-102-SY-101	Thu 11/1/12	Mon 3/4/13
17	S-112-SY-101	Thu 11/1/12	Mon 3/4/13
7	C-102-AY-101	Mon 9/15/14	Sat 12/6/14
8	C-102-AZ-101	Mon 12/15/14	Sat 3/7/15
13	S-102-SY-101	Tue 6/9/15	Sun 9/13/15
18	S-112-SY-101	Tue 6/9/15	Sun 9/13/15
1	A-101-AY-102	Tue 7/26/16	Tue 2/14/17
4	AX-101-AY-102	Fri 1/6/17	Tue 2/14/17
14	S-102-SY-101	Wed 6/28/17	Mon 9/25/17
15	S-103-SY-101	Wed 6/28/17	Mon 9/25/17
2	A-101-AY-102	Fri 11/17/17	Wed 3/14/18
5	AX-101-AY-102	Fri 11/17/17	Wed 3/14/18
3	A-101-AY-102	Fri 5/11/18	Wed 9/5/18
6	AX-101-AY-102	Fri 5/11/18	Wed 9/5/18



Project: sstsluic
Date: Tue 1/11/00

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

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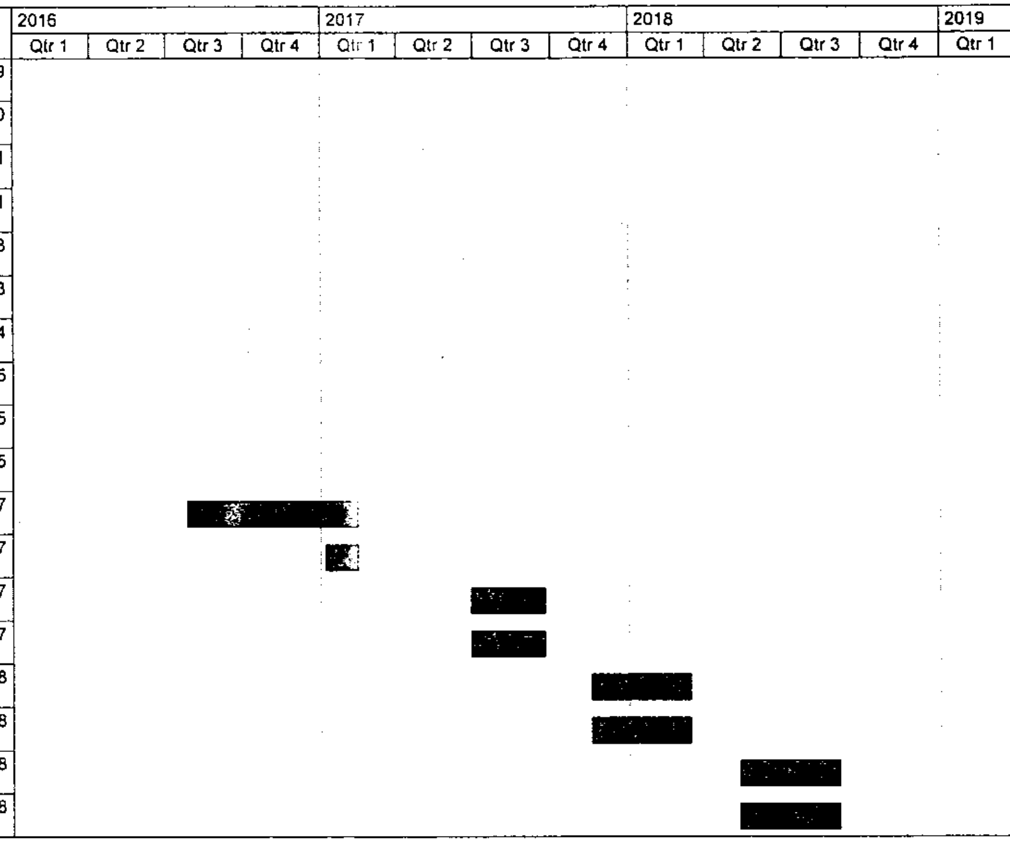
Figure A-3. Single-Shell Tank to Double-Shell Tank Retrieval Activities. (3 Sheets)

ID	Indicators	Task Name	Start	Finish
9		C-104-AY-102	Wed 9/23/09	Fri 12/11/09
10		C-104-AZ-102	Fri 12/11/09	Sun 3/7/10
16		S-112-SY-101	Tue 4/12/11	Thu 7/14/11
11		S-102-SY-101	Mon 6/27/11	Thu 7/14/11
12		S-102-SY-101	Thu 11/1/12	Mon 3/4/13
17		S-112-SY-101	Thu 11/1/12	Mon 3/4/13
7		C-102-AY-101	Mon 9/15/14	Sat 12/6/14
8		C-102-AZ-101	Mon 12/15/14	Sat 3/7/15
13		S-102-SY-101	Tue 6/9/15	Sun 9/13/15
18		S-112-SY-101	Tue 6/9/15	Sun 9/13/15
1		A-101-AY-102	Tue 7/26/16	Tue 2/14/17
4		AX-101-AY-102	Fri 1/6/17	Tue 2/14/17
14		S-102-SY-101	Wed 6/28/17	Mon 9/25/17
15		S-103-SY-101	Wed 6/28/17	Mon 9/25/17
2		A-101-AY-102	Fri 11/17/17	Wed 3/14/18
5		AX-101-AY-102	Fri 11/17/17	Wed 3/14/18
3		A-101-AY-102	Fri 5/11/18	Wed 9/5/18
6		AX-101-AY-102	Fri 5/11/18	Wed 9/5/18



Project: sstsluic
Date: Tue 1/11/00

Task; Split; Progress; Milestone; Summary; Rolled Up Task; Rolled Up Split; Rolled Up Milestone; Rolled Up Progress; External Tasks; Project Summary

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Figure A-4. Concurrent Demands for Dilution and Flush Solutions. (6 Sheets)

ID	Task Name	Start	Finish
1	Line Flush: 244-S to SY-102	Wed 3/8/00	Wed 3/8/00
2	Line Flush: 244-U to SY-102	Wed 3/8/00	Wed 3/8/00
3	Line Flush: SY-102 to AP-106	Wed 3/8/00	Wed 3/8/00
4	Line Flush: 244-S to SY-102	Wed 3/22/00	Wed 3/22/00
5	Line Flush: 244-U to SY-102	Wed 3/22/00	Wed 3/22/00
6	Line Flush: 244-S to SY-102	Fri 8/11/00	Fri 8/11/00
7	Line Flush: 244-U to SY-102	Fri 8/11/00	Fri 8/11/00
8	Line Flush: 244-S to SY-102	Tue 9/26/00	Tue 9/26/00
9	Line Flush: 244-U to SY-102	Tue 9/26/00	Tue 9/26/00
10	Line Flush: AP-107 to AW-102	Tue 9/26/00	Tue 9/26/00
11	Line Flush: SY-102 to AP-107	Tue 9/26/00	Tue 9/26/00
12	Line Flush: AW-102 to 242-A	Sun 10/1/00	Sun 10/1/00
13	Line Flush: AW-106 to AW-104	Sun 10/1/00	Sun 10/1/00
14	Line Flush: 244-S to SY-102	Wed 12/13/00	Wed 12/13/00
15	Line Flush: 244-U to SY-102	Wed 12/13/00	Wed 12/13/00
16	Line Flush: 244-U to SY-102	Sat 2/10/01	Sat 2/10/01
17	Line Flush: SY-102 to AP-107	Sat 2/10/01	Sat 2/10/01
18	Line Flush: 244-BX to AP-107	Mon 4/16/01	Mon 4/16/01
19	Line Flush: 244-U to SY-102	Mon 4/16/01	Mon 4/16/01
20	Line Flush: 244-S to SY-102	Fri 5/4/01	Fri 5/4/01
21	Line Flush: 244-U to SY-102	Fri 5/4/01	Fri 5/4/01
22	Line Flush: 244-BX to AP-107	Sun 7/8/01	Sun 7/8/01
23	Line Flush: 244-S to SY-102	Sun 7/8/01	Sun 7/8/01
24	Line Flush: 244-S to SY-102	Wed 8/22/01	Wed 8/22/01
25	Line Flush: AW-102 to 242-A	Wed 8/22/01	Wed 8/22/01
26	Line Flush: 244-S to SY-102	Wed 8/29/01	Wed 8/29/01
27	Line Flush: 244-U to SY-102	Wed 8/29/01	Wed 8/29/01
28	Line Flush: 244-S to SY-102	Wed 9/26/01	Wed 9/26/01
29	Line Flush: AP-108 to AP-107	Wed 9/26/01	Wed 9/26/01
30	Line Flush: 244-BX to AP-107	Thu 10/4/01	Thu 10/4/01
31	Line Flush: 244-U to SY-102	Thu 10/4/01	Thu 10/4/01

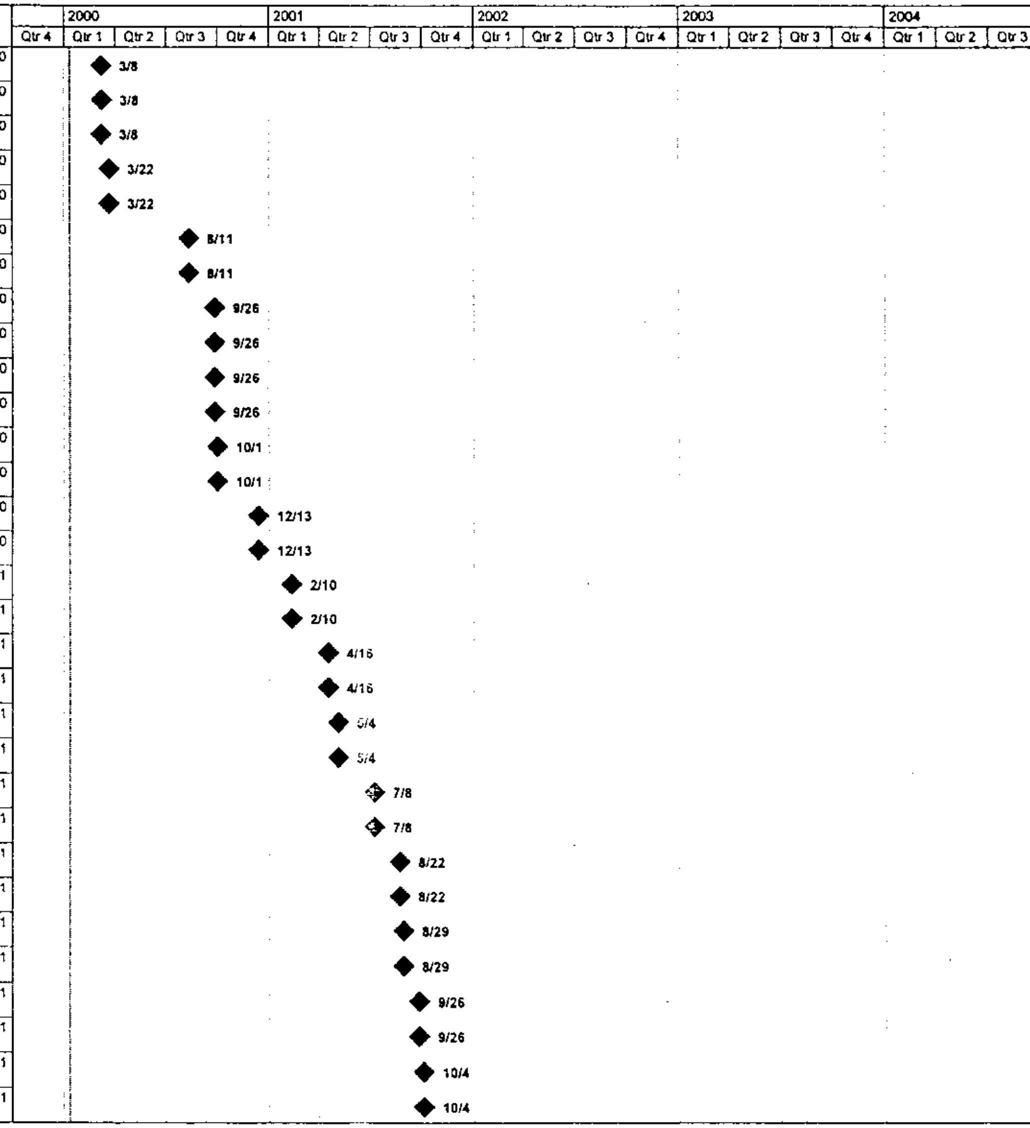

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Figure A-4. Concurrent Demands for Dilution and Flush Solutions. (6 Sheets)

ID		Task Name	Start	Finish
32		Line Flush: 244-S to SY-102	Sun 10/7/01	Sun 10/7/01
33		Line Flush: AW-106 to AP-104	Sun 10/7/01	Sun 10/7/01
34		Line Flush: 244-S to SY-102	Thu 10/25/01	Thu 10/25/01
35		Line Flush: 244-U to SY-102	Thu 10/25/01	Thu 10/25/01
36		Line Flush: 244-BX to AP-107	Tue 1/22/02	Tue 1/22/02
37		Line Flush: 244-S to SY-102	Tue 1/22/02	Tue 1/22/02
38		Line Flush: SY-102 to AP-107	Tue 1/22/02	Tue 1/22/02
39		Line Flush: 244-S to SY-102	Sat 3/9/02	Sat 3/9/02
40		Line Flush: 244-U to SY-102	Sat 3/9/02	Sat 3/9/02
41		Line Flush: 244-BX to AP-107	Tue 3/26/02	Tue 3/26/02
42		Line Flush: 244-S to SY-102	Tue 3/26/02	Tue 3/26/02
43		Line Flush: 244-S to SY-102	Sun 3/31/02	Sun 3/31/02
44		Line Flush: 244-U to SY-102	Sun 3/31/02	Sun 3/31/02
45		Line Flush: 244-S to SY-102	Fri 4/12/02	Fri 4/12/02
46		Line Flush: 244-U to SY-102	Fri 4/12/02	Fri 4/12/02
47		Line Flush: 244-S to SY-102	Fri 4/26/02	Fri 4/26/02
48		Line Flush: 244-U to SY-102	Fri 4/26/02	Fri 4/26/02
49		Line Flush: 244-BX to AP-107	Sat 5/4/02	Sat 5/4/02
50		Line Flush: 244-S to SY-102	Sat 5/4/02	Sat 5/4/02
51		Line Flush: 244-S to SY-102	Sat 8/17/02	Sat 8/17/02
52		Line Flush: 244-U to SY-102	Sat 8/17/02	Sat 8/17/02
53		Line Flush: 244-S to SY-102	Tue 9/3/02	Tue 9/3/02
54		Line Flush: AP-108 to AP-107	Tue 9/3/02	Tue 9/3/02
55		Line Flush: 244-CR to AP-108	Mon 9/30/02	Mon 9/30/02
56		Line Flush: 244-S to SY-102	Mon 9/30/02	Mon 9/30/02
57		Line Flush: 244-BX to AP-107	Thu 10/31/02	Thu 10/31/02
58		Line Flush: 244-S to SY-102	Thu 10/31/02	Thu 10/31/02
59		Line Flush: 244-U to SY-102	Thu 4/24/03	Thu 4/24/03
60		Line Flush: SY-102 to AP-107	Thu 4/24/03	Thu 4/24/03
61		In-Line Dilution: AN-107 to AN-106	Mon 9/5/05	Wed 9/7/05
62		Line Flush: AN-107 to AN-106	Wed 9/7/05	Wed 9/7/05

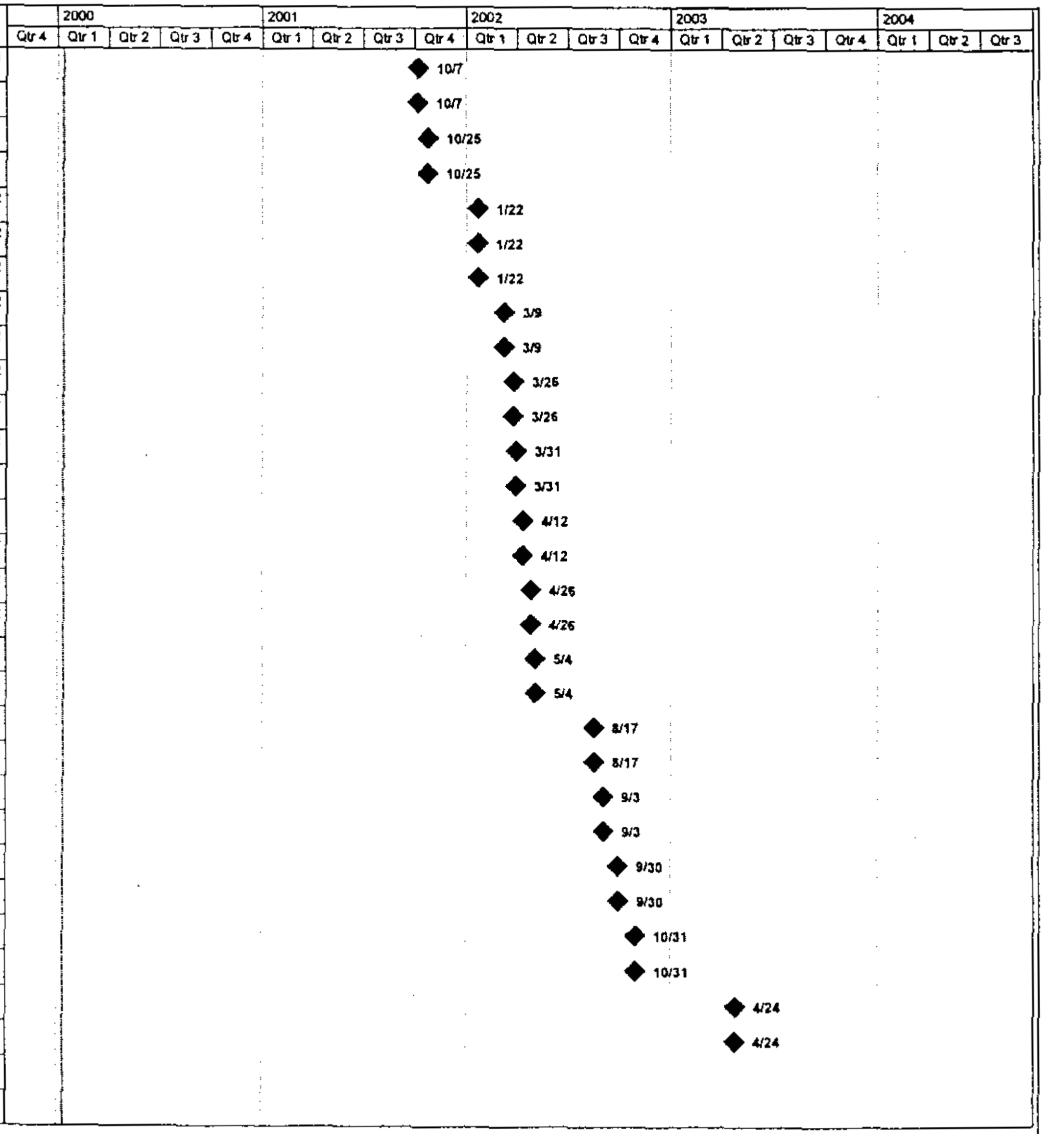

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Figure A-4. Concurrent Demands for Dilution and Flush Solutions. (6 Sheets)

ID	Task Name	Start	Finish
32	Line Flush: 244-S to SY-102	Sun 10/7/01	Sun 10/7/01
33	Line Flush: AW-106 to AP-104	Sun 10/7/01	Sun 10/7/01
34	Line Flush: 244-S to SY-102	Thu 10/25/01	Thu 10/25/01
35	Line Flush: 244-U to SY-102	Thu 10/25/01	Thu 10/25/01
36	Line Flush: 244-BX to AP-107	Tue 1/22/02	Tue 1/22/02
37	Line Flush: 244-S to SY-102	Tue 1/22/02	Tue 1/22/02
38	Line Flush: SY-102 to AP-107	Tue 1/22/02	Tue 1/22/02
39	Line Flush: 244-S to SY-102	Sat 3/9/02	Sat 3/9/02
40	Line Flush: 244-U to SY-102	Sat 3/9/02	Sat 3/9/02
41	Line Flush: 244-BX to AP-107	Tue 3/26/02	Tue 3/26/02
42	Line Flush: 244-S to SY-102	Tue 3/26/02	Tue 3/26/02
43	Line Flush: 244-S to SY-102	Sun 3/31/02	Sun 3/31/02
44	Line Flush: 244-U to SY-102	Sun 3/31/02	Sun 3/31/02
45	Line Flush: 244-S to SY-102	Fri 4/12/02	Fri 4/12/02
46	Line Flush: 244-U to SY-102	Fri 4/12/02	Fri 4/12/02
47	Line Flush: 244-S to SY-102	Fri 4/26/02	Fri 4/26/02
48	Line Flush: 244-U to SY-102	Fri 4/26/02	Fri 4/26/02
49	Line Flush: 244-BX to AP-107	Sat 5/4/02	Sat 5/4/02
50	Line Flush: 244-S to SY-102	Sat 5/4/02	Sat 5/4/02
51	Line Flush: 244-S to SY-102	Sat 8/17/02	Sat 8/17/02
52	Line Flush: 244-U to SY-102	Sat 8/17/02	Sat 8/17/02
53	Line Flush: 244-S to SY-102	Tue 9/3/02	Tue 9/3/02
54	Line Flush: AP-108 to AP-107	Tue 9/3/02	Tue 9/3/02
55	Line Flush: 244-CR to AP-108	Mon 9/30/02	Mon 9/30/02
56	Line Flush: 244-S to SY-102	Mon 9/30/02	Mon 9/30/02
57	Line Flush: 244-BX to AP-107	Thu 10/31/02	Thu 10/31/02
58	Line Flush: 244-S to SY-102	Thu 10/31/02	Thu 10/31/02
59	Line Flush: 244-U to SY-102	Thu 4/24/03	Thu 4/24/03
60	Line Flush: SY-102 to AP-107	Thu 4/24/03	Thu 4/24/03
61	In-Line Dilution: AN-107 to AN-106	Mon 9/5/05	Wed 9/7/05
62	Line Flush: AN-107 to AN-106	Wed 9/7/05	Wed 9/7/05

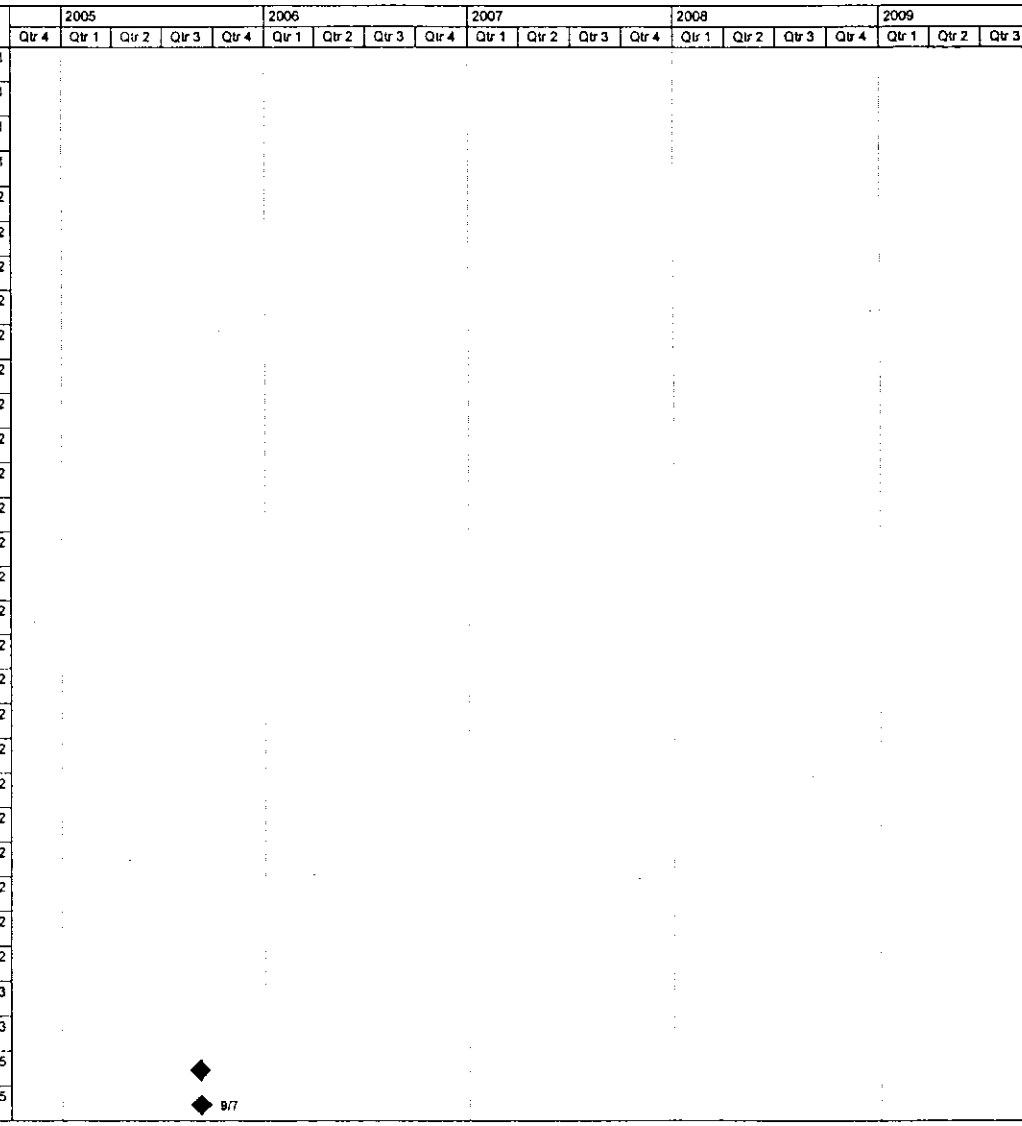

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Figure A-4. Concurrent Demands for Dilution and Flush Solutions. (6 Sheets)

ID	Task Name	Start	Finish
63	Line Flush: AP-107 to AW-102	Wed 9/7/05	Wed 9/7/05
64	Tank Heel Flush: to AN-101	Wed 9/7/05	Thu 9/8/05
65	In-Line Dilution: AN-104 to AN-101	Fri 9/9/05	Tue 9/13/05
66	Line Flush: AN-104 to AN-101	Tue 9/13/05	Tue 9/13/05
67	Line Flush: AP-107 to AW-102	Tue 9/13/05	Tue 9/13/05
68	In-Tank Dilution: to AN-104	Wed 9/14/05	Mon 9/19/05
69	Line Flush: AW-106 to AP-107	Sat 9/17/05	Sat 9/17/05
70	In-Line Dilution: AN-102 to AN-106	Fri 12/9/05	Tue 12/13/05
71	Line Flush: AN-106 to BNFL	Fri 12/9/05	Fri 12/9/05
72	In-Line Dilution: AN-105 to AN-104	Tue 9/16/08	Sat 9/20/08
73	Line Flush: AY-102 to BNFL	Thu 9/18/08	Thu 9/18/08
74	Line Flush: AN-106 to BNFL	Tue 6/2/09	Tue 6/2/09
75	Line Flush: AY-101 to BNFL	Tue 6/2/09	Tue 6/2/09
76	Tank Heel Flush: to AN-106	Tue 6/2/09	Tue 6/2/09
77	In-Line Dilution: AN-103 to AN-105	Wed 2/16/11	Sun 2/20/11
78	Line Flush: AN-105 to BNFL	Wed 2/16/11	Wed 2/16/11
79	Line Flush: AN-105 to AN-107	Tue 4/24/12	Tue 4/24/12
80	In-Line Dilution: AW-104 to AN-105	Tue 4/24/12	Sat 4/28/12
81	Line Flush: AW-106 to AW-102	Fri 4/27/12	Fri 4/27/12
82	Line Flush: AN-101 to BNFL	Thu 6/26/14	Thu 6/26/14
83	Line Flush: AN-104 to AW-104	Thu 6/26/14	Thu 6/26/14
84	Tank Heel Flush: to AN-101	Thu 6/26/14	Thu 6/26/14
85	In-Line Dilution: AP-105 to AN-101	Fri 6/27/14	Wed 7/2/14
86	Line Flush: AY-102 to BNFL	Sat 6/28/14	Sat 6/28/14
87	Line Flush: AY-102 to BNFL	Mon 9/15/14	Mon 9/15/14
88	In-Line Dilution: AP-101 to AN-101	Thu 12/10/15	Mon 12/14/15
89	Line Flush: AZ-102 to BNFL	Sat 12/12/15	Sat 12/12/15
90	Line Flush: AN-104 to AW-106	Mon 5/7/18	Mon 5/7/18
91	Line Flush: AN-104 to AW-102	Mon 5/7/18	Mon 5/7/18
92	Line Flush: AZ-102 to BNFL	Thu 9/5/19	Thu 9/5/19
93	Line Flush: AZ-102 to BNFL	Thu 9/5/19	Thu 9/5/19

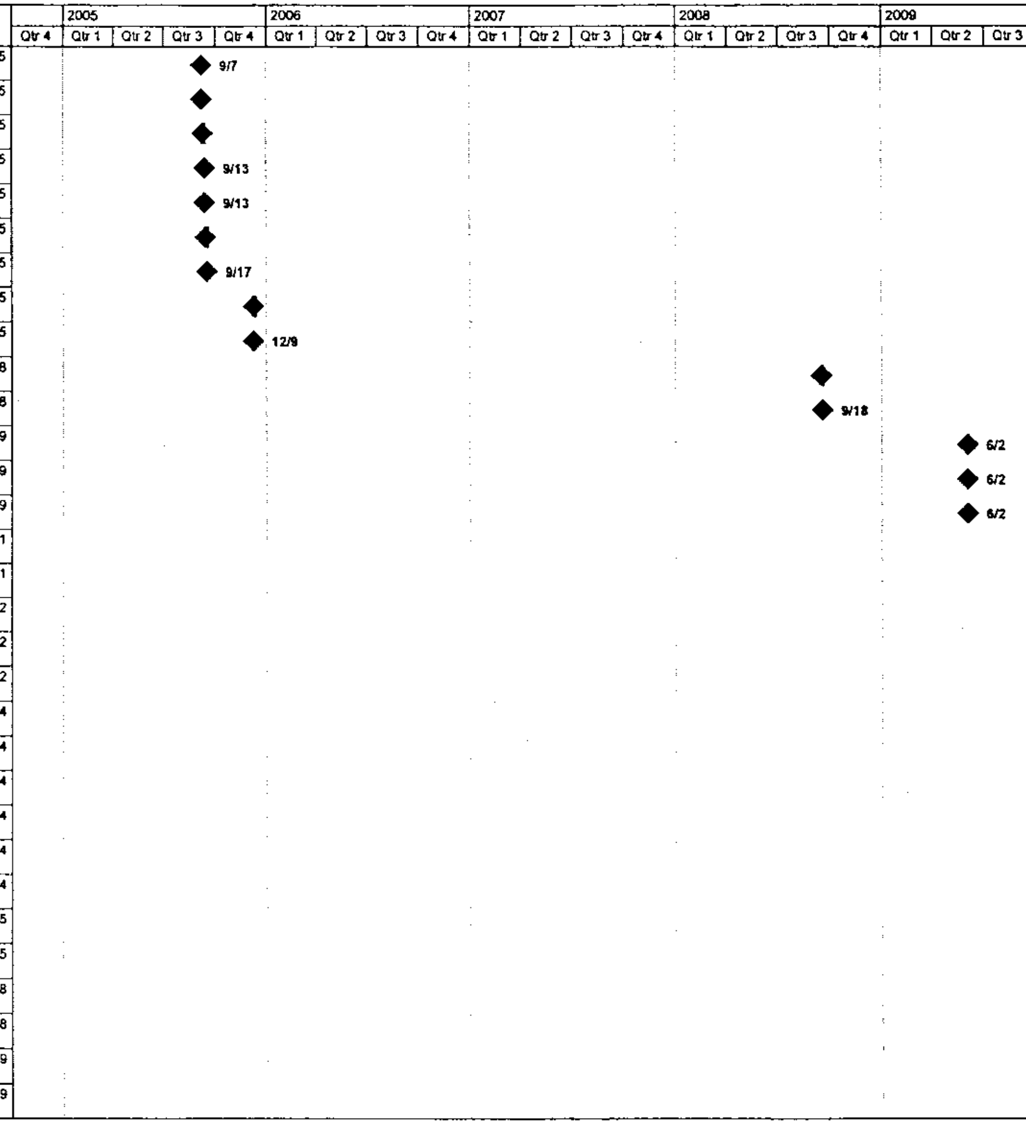

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Figure A-4. Concurrent Demands for Dilution and Flush Solutions. (6 Sheets)

ID	Task Name	Start	Finish
63	Line Flush: AP-107 to AW-102	Wed 9/7/05	Wed 9/7/05
64	Tank Heel Flush: to AN-101	Wed 9/7/05	Thu 9/8/05
65	In-Line Dilution: AN-104 to AN-101	Fri 9/9/05	Tue 9/13/05
66	Line Flush: AN-104 to AN-101	Tue 9/13/05	Tue 9/13/05
67	Line Flush: AP-107 to AW-102	Tue 9/13/05	Tue 9/13/05
68	In-Tank Dilution: to AN-104	Wed 9/14/05	Mon 9/19/05
69	Line Flush: AW-106 to AP-107	Sat 9/17/05	Sat 9/17/05
70	In-Line Dilution: AN-102 to AN-106	Fri 12/9/05	Tue 12/13/05
71	Line Flush: AN-106 to BNFL	Fri 12/9/05	Fri 12/9/05
72	In-Line Dilution: AN-105 to AN-104	Tue 9/16/08	Sat 9/20/08
73	Line Flush: AY-102 to BNFL	Thu 9/18/08	Thu 9/18/08
74	Line Flush: AN-106 to BNFL	Tue 6/2/09	Tue 6/2/09
75	Line Flush: AY-101 to BNFL	Tue 6/2/09	Tue 6/2/09
76	Tank Heel Flush: to AN-106	Tue 6/2/09	Tue 6/2/09
77	In-Line Dilution: AN-103 to AN-105	Wed 2/16/11	Sun 2/20/11
78	Line Flush: AN-105 to BNFL	Wed 2/16/11	Wed 2/16/11
79	Line Flush: AN-105 to AN-107	Tue 4/24/12	Tue 4/24/12
80	In-Line Dilution: AW-104 to AN-105	Tue 4/24/12	Sat 4/28/12
81	Line Flush: AW-106 to AW-102	Fri 4/27/12	Fri 4/27/12
82	Line Flush: AN-101 to BNFL	Thu 6/26/14	Thu 6/26/14
83	Line Flush: AN-104 to AW-104	Thu 6/26/14	Thu 6/26/14
84	Tank Heel Flush: to AN-101	Thu 6/26/14	Thu 6/26/14
85	In-Line Dilution: AP-105 to AN-101	Fri 6/27/14	Wed 7/2/14
86	Line Flush: AY-102 to BNFL	Sat 6/28/14	Sat 6/28/14
87	Line Flush: AY-102 to BNFL	Mon 9/15/14	Mon 9/15/14
88	In-Line Dilution: AP-101 to AN-101	Thu 12/10/15	Mon 12/14/15
89	Line Flush: AZ-102 to BNFL	Sat 12/12/15	Sat 12/12/15
90	Line Flush: AN-104 to AW-106	Mon 5/7/18	Mon 5/7/18
91	Line Flush: AN-104 to AW-102	Mon 5/7/18	Mon 5/7/18
92	Line Flush: AZ-102 to BNFL	Thu 9/5/19	Thu 9/5/19
93	Line Flush: AZ-102 to BNFL	Thu 9/5/19	Thu 9/5/19

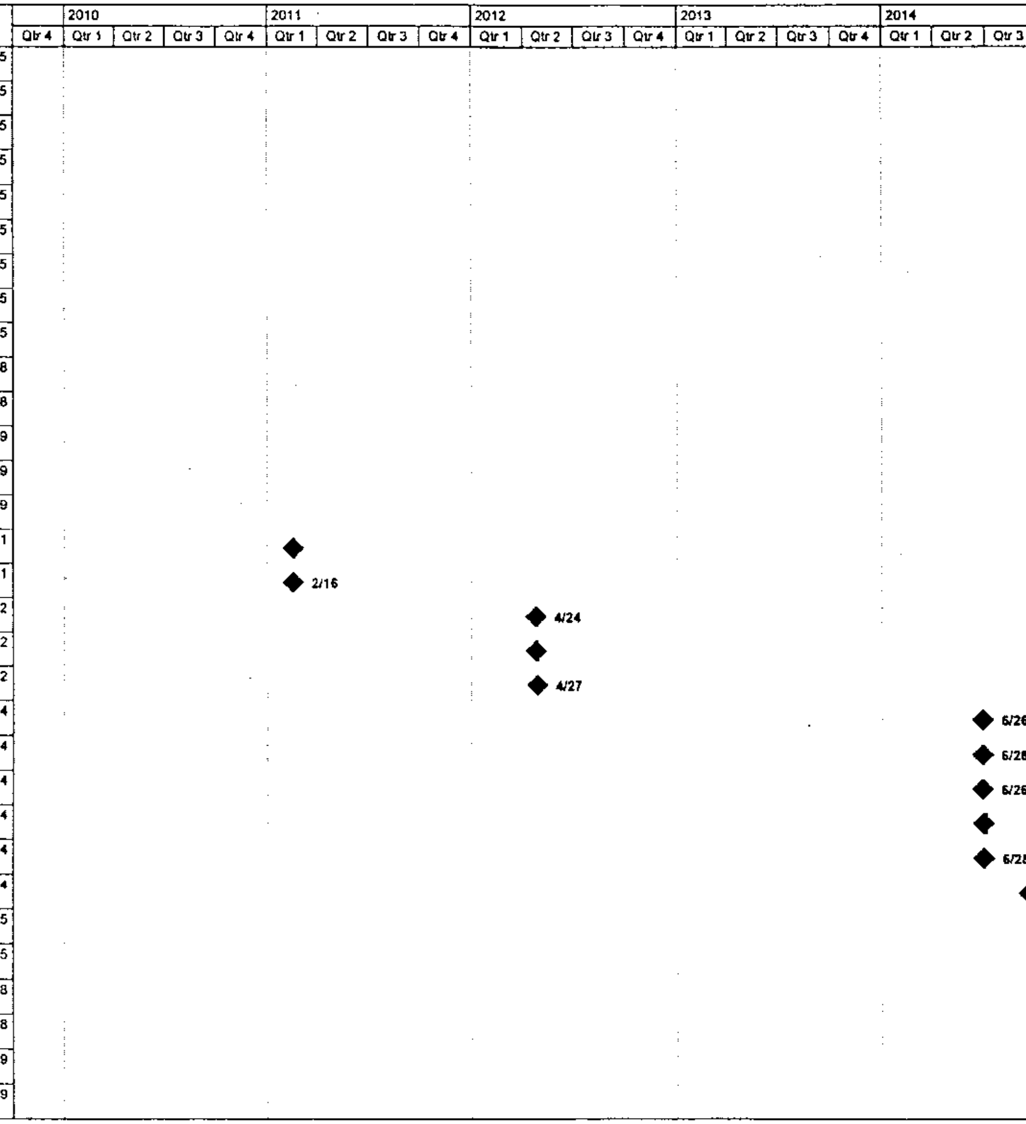

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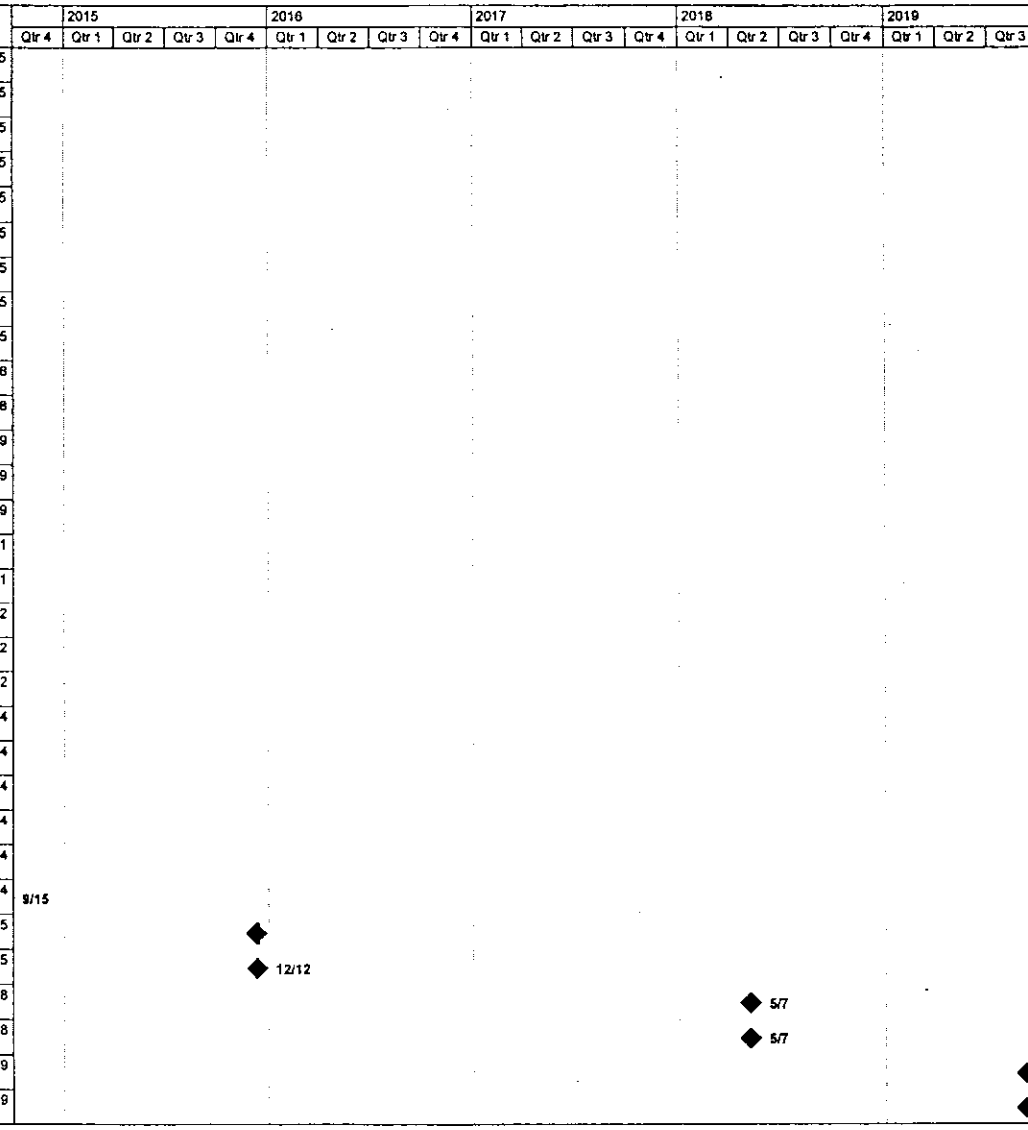
Figure A-4. Concurrent Demands for Dilution and Flush Solutions. (6 Sheets)

ID	Task Name	Start	Finish
63	Line Flush: AP-107 to AW-102	Wed 9/7/05	Wed 9/7/05
64	Tank Heel Flush: to AN-101	Wed 9/7/05	Thu 9/8/05
65	In-Line Dilution: AN-104 to AN-101	Fri 9/9/05	Tue 9/13/05
66	Line Flush: AN-104 to AN-101	Tue 9/13/05	Tue 9/13/05
67	Line Flush: AP-107 to AW-102	Tue 9/13/05	Tue 9/13/05
68	In-Tank Dilution: to AN-104	Wed 9/14/05	Mon 9/19/05
69	Line Flush: AW-106 to AP-107	Sat 9/17/05	Sat 9/17/05
70	In-Line Dilution: AN-102 to AN-106	Fri 12/9/05	Tue 12/13/05
71	Line Flush: AN-106 to BNFL	Fri 12/9/05	Fri 12/9/05
72	In-Line Dilution: AN-105 to AN-104	Tue 9/16/08	Sat 9/20/08
73	Line Flush: AY-102 to BNFL	Thu 9/18/08	Thu 9/18/08
74	Line Flush: AN-106 to BNFL	Tue 6/2/09	Tue 6/2/09
75	Line Flush: AY-101 to BNFL	Tue 6/2/09	Tue 6/2/09
76	Tank Heel Flush: to AN-106	Tue 6/2/09	Tue 6/2/09
77	In-Line Dilution: AN-103 to AN-105	Wed 2/16/11	Sun 2/20/11
78	Line Flush: AN-105 to BNFL	Wed 2/16/11	Wed 2/16/11
79	Line Flush: AN-105 to AN-107	Tue 4/24/12	Tue 4/24/12
80	In-Line Dilution: AW-104 to AN-105	Tue 4/24/12	Sat 4/28/12
81	Line Flush: AW-106 to AW-102	Fri 4/27/12	Fri 4/27/12
82	Line Flush: AN-101 to BNFL	Thu 6/26/14	Thu 6/26/14
83	Line Flush: AN-104 to AW-104	Thu 6/26/14	Thu 6/26/14
84	Tank Heel Flush: to AN-101	Thu 6/26/14	Thu 6/26/14
85	In-Line Dilution: AP-105 to AN-101	Fri 6/27/14	Wed 7/2/14
86	Line Flush: AY-102 to BNFL	Sat 6/28/14	Sat 6/28/14
87	Line Flush: AY-102 to BNFL	Mon 9/15/14	Mon 9/15/14
88	In-Line Dilution: AP-101 to AN-101	Thu 12/10/15	Mon 12/14/15
89	Line Flush: AZ-102 to BNFL	Sat 12/12/15	Sat 12/12/15
90	Line Flush: AN-104 to AW-106	Mon 5/7/18	Mon 5/7/18
91	Line Flush: AN-104 to AW-102	Mon 5/7/18	Mon 5/7/18
92	Line Flush: AZ-102 to BNFL	Thu 9/5/19	Thu 9/5/19
93	Line Flush: AZ-102 to BNFL	Thu 9/5/19	Thu 9/5/19



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ATTACHMENT 1

DSI, HEATED WATER REQUIREMENTS

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DON'T SAY IT — *Write It!*

TO:	T. J. Conrads	R3-73
	C. E. Grenard	R3-73
	D. P. Fassett	R3-73
cc:	J. S. Garfield	R3-73

DATE: June 7, 2000

FROM: R. M. Orme R3-73

Telephone: 372-0035

SUBJECT: Heated Water Requirements

The February 16, 2000 DSI by the same title is hereby updated. The entire text of the previous DSI is repeated below with the obsolete wording deleted by strikethrough and the replacement text in a bold font.

Water is used for in-tank dissolution of salts, in-tank dilution of HLW slurries (conceivable, but no instance of this use is currently identified), preheating transfer lines, in-line dilution of transfers, and tank heel flushing. These uses place the following demands upon the water delivery system:

- for in-tank dissolution (LAW), up to half of the tank volume at the temperature of the waste being treated. (We assume flow rates approaching 530 L/min (140 gpm) but the rate of addition is not critical).
- for in-tank dilution (HLW), ~~no need to heat the water addition~~ **up to the temperature that the diluent system will deliver.** (We assume flow rates approaching 530 L/min (140 gpm) but the rate of addition is not critical).
- for preheating transfer lines, up to two transfer line volumes at the temperature of the subsequent LAW transfer. (We assume flow rates approaching 530 L/min (140 gpm) but the rate of addition is not critical).
- for in-line dilution (LAW), up to 175 L/min (46 gpm) at the temperature of the LAW being transferred. **This is equivalent to a 50 vol% dilution when the total transfer rate is 530 L/min.**
- for in-line dilution (HLW), ~~no need to heat the water addition~~ **up to 175 L/min (46 gpm) at the highest temperature that the diluent system will deliver. (This demand is specific to sludge transfers from AW-103 and AW-104 where a high concentration carrier liquid is expected that needs to be diluted for stability reasons).**
- for tank heel flushing, typical volume is 380 – 760 m^3 (100 – 200 kgals) at the temperature of the heel being flushed. (We expect flow rates approaching 530 L/min (140 gpm) but the rate of addition is not critical).

The flowsheets don't call for heated line flushes at this time. The system should be capable of delivering water within 5 °C of the desired temperature.

<u>In tank dissolution basis (LAW)</u>

Favorable viscosity and solution stability, both of which are concentration and temperature sensitive, are the drivers for making heated water additions. For LAW, we add water primarily to reduce the density below 1.35 so as not to invoke the requirement for a line plugging

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evaluation. We don't want to cool or heat the waste significantly from its normal equilibrium storage temperature because of the precipitation induction period exhibited by several waste components. Solution stability is important because the solids limit is 2 wt%. Should be relatively little heating from mixer pumps because of short duration.

In-tank dilution basis (HLW)

~~Water added to dilute the solids concentration of HLW slurries need not be heated.~~ **The temperature of added water needs to be weighed against the expected duration of sludge mobilization.** Cold water addition ~~in conjunction with extended mixer pump operation actually~~ helps to control temperature allowing more time for mobilization **of difficult sludges.** ~~Solution stability is not as important for HLW because the~~ **The** target range for solids content is very wide (20 – 200 g solids/L), **so there is considerable flexibility for adding water when solution stability is the objective.**

Preheating transfer lines (LAW)

The transfer line may need to be preheated for selected transfers. S. L. Hecht recently modeled heated water flowing at 6 ft/sec in buried, insulated pipelines of various lengths (from 770 ft to 7000 ft). After a pipeline has come to equilibrium, the temperature change of the fluid from end to end is typically 5 ^{0}F in a 1 mile transfer line. However, during the transient period while the pipe is heating, the temperature of the liquid can change appreciably. Significant changes in waste temperature are avoided by preheating the line with one to two line volumes of water at the temperature of the proposed transfer. For LAW tanks, 38 °C (100 °F) would be typical.

In-line dilution basis (LAW)

For the reference waste transfer rate of 530 L/min (140gpm), the maximum in-line dilution rate is 175 L/min (46 gpm) at the temperature of the waste. This will support a 50% dilution during a supernate transfer. For LAW tanks, 38 °C (100 °F) would be typical.

In-line dilution basis (HLW)

Certain HLW transfers have been identified where in-tank dilution isn't feasible and solution stability could be marginal. Since HLW is being mobilized, diluted, and transferred at the same time, an amount and temperature of dilution water has to be determined that will simultaneously satisfy the NPSH requirements of the transfer pump, yield a stable liquid phase, and yield a solids content between 20-200 g/L~~. Cold water added for in-line dilutions improves the NPSH of the heated slurry. Attention to solution stability in HLW feed deliveries is less important because the acceptable range of solids content is so wide (20-200 g/L).~~

Tank heel flushing

Temperature will enhance the dissolution of low solubility salts left over after LAW tank after retrieval will.

Miscellaneous

A collateral benefit of line preheating is verification that all the elements of the transfer system are in proper order before the waste starts flowing (instruments reading as expected, valve positions correct, water arriving at the intended destination). The preheat volume is equivalent to a line flush, and in most cases, a small fraction of the volume added to do an in-line or in-tank dilution.

~~Diluting HLW feeds with heated water is believed to be an unlikely requirement at this time.~~ The highest storage temperature likely to be seen in any DST is 65 °C (150 °F) – the current temperature in AZ-101.

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