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ENGINEERING DATA TRANSMITTAL

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Long Length Contaminated Equipment Maintenance Plan

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Prepared by CH2Mhill Hanford Group Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

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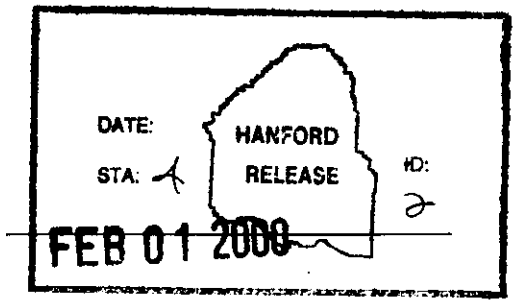
Abstract: This maintenance plan contains the listing of maintenance activities and the determined frequency for the LLCE trailers for the River Protection Project (RPP).



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PURPOSE

The purpose of this document is to provide the maintenance requirements of the Long Length Contaminated Equipment (LLCE) trailers and provide a basis for the maintenance frequencies selected.

SCOPE

This document is applicable to the LLCE Receiver trailer and Transport trailer assembled by Mobilized Systems Inc. (MSI). Equipment used in conjunction with, or in support of, these trailers is not included. This document does not provide the maintenance requirements for checkout and startup of the equipment following the extended lay-up status which began in the mid 1990s. These requirements will be specified in other documentation.

BACKGROUND

The LLCE disposal system is comprised of equipment and processes for retrieving, packaging, and transporting long length equipment from Hanford waste tanks. The LLCE transport system will be used during the LLCE disposal process to handle and move long length radioactive contaminated equipment into high density plastic burial containers. The transportation system consists of two trailers: a receiver trailer to receiver equipment from the waste tanks and a transport trailer to transport the burial container to the disposal facility.

Since 1996, these trailers have been parked in the laydown yard, north of 2704 HV, exposed to the weather. They have never been put into service.

MSI has provided 'product literature sheets' (cutsheets) for the components used in the assembly of the trailers. This information is provided in Hanford site vendor information file (VI) 22809. However, there has been no definitive maintenance plan written for these trailers. This document will discuss and list the maintenance required for the LLCE transport system.

Three general types of maintenance activities have been identified within the vendor documentation for the LLCE trailers: pre-use maintenance, preventative maintenance, and long-term storage activities.

Pre-use maintenance activities are tasks that will be scheduled and performed on operating equipment and systems prior to each campaign. Pre-use maintenance activities include lubrication, adjustments, and inspections.

Preventative maintenance includes those activities necessary to evaluate the condition of equipment, maintain equipment in the operational mode, prevent equipment breakdown, and identify corrective maintenance. Preventative maintenance activities include periodic lubrication, adjustments, calibrations, and inspections. Any calibration of equipment shall be included in the preventative maintenance schedule. The frequency selected for preventative maintenance tasks is based primarily on the estimated operating time of the LLCE trailers.

Long term maintenance activities are those tasks used to prevent deterioration of equipment during long term storage when equipment is not used.

Implementation of these recommended maintenance activities will ensure the trailers are maintained in an operational condition.

DISCUSSION

Appendix A is a compilation of all available vendor information, maintenance recommendations, and information from previous documents produced for the LLCETS. Appendix A includes all vendor recommended maintenance requirements and frequencies for the trailers' main components.

The information in Appendix A is not in a form which can be readily usable for setting up a maintenance program within RPP for the LLCETS. Some vendor recommended frequencies are based upon of time, others are based upon time of operation or distance traveled. The vendor recommendations are assumed to be based upon 160 hours per month of operation. This is a much higher usage rate than will actually occur. A more realistic assessment of LLCETS usage was used in preparation of this document. This document was based on the assumption that the equipment would be utilized for one LLCE removal per month, and that both the receiver and the transport trailer would be operated for a maximum of 16 hours per LLCE removal.

This document divides recommended maintenance activities into four categories; Pre-use, Preventative, Upon Request and Long-Term Storage. Separation of the maintenance tasks into the four categories was determined by the cognizant engineer for the LLCETS. This decision was based on vendor component information, craft knowledge and recommendations, discussions with MSI, and engineering judgement.

Pre-use maintenance activities are those activities to be performed prior to each trailer deployment. Appendix B lists the pre-use maintenance inspections. This includes all the items from Appendix A which are recommended to be performed on a daily or other short-term basis, or that Engineering recommends being completed to ensure safe equipment operation. The items listed in Appendix B under 'Pre-use' will be performed as an integral prerequisite step of the operational work package. At this point, the operational work package has not been developed, however this work package will have numerous prerequisite steps that must be completed before field deployment.

Preventative maintenance includes all routine equipment calibrations, lubrications, leak checks, and preventive maintenance activities. A single preventative maintenance frequency of six months was selected to provide one outage period rather than having numerous small outages. Appendix C lists the preventative maintenance requirements for the LLCETS. Items listed in Appendix A with a recommended frequency of less than 6 months or 500 hours of operation are included in Appendix C. Assuming one LLCE removal per month and 16 hours of operation for each trailer per LLCE removal indicates each trailer will be operated about 100 hours in a six month period. This estimated operating time in a six month period will be about 60% of what the vendor assumed would occur in one month. Therefore, performing maintenance every six months on items recommended by the vendor to be maintained on a one to six month or 500 hours of operation basis is acceptable. Those items recommended to be performed more frequent than once per month are included in the pre-use maintenance requirements in Appendix B.

Upon request items are those which will only be required when specifically requested by operations, maintenance, or engineering personnel. Upon request items are listed in Appendix D. Most recommendations listed in Appendix A that are not in the pre-use or six month maintenance categories are categorized as 'upon request' maintenance. These are primarily requirements whose recommended frequency was greater than six months or 500 hours of operation. Because of unknowns with the LLCETS deployment schedule, it is prudent to only list these items as upon request at this time.

Appendix E lists components that the vendor information states have long term storage requirements. Based upon vendor information and knowledge gained by Engineering, Operations, and Maintenance personnel from other RPP projects, long term storage is assumed to be an anticipated non-use condition for a period of at least one year.

SUMMARY

The following are the recommended maintenance frequencies for the LLCE Transport trailer and Receiver trailer.

Appendix B, 'Pre-Use Maintenance', lists the recommended pre-use maintenance inspections required prior to field deployment. Completing the pre-use inspections will be part of the operating work package prerequisites.

Appendix C, 'Six Month Preventative Maintenance Requirements', lists the maintenance items that will be performed every six months.

Appendix D, 'Upon Request Maintenance', lists the maintenance items that the vendor recommends to have completed but does not fall within the six month or 500 hour criteria of Appendix C, and will be performed on an as needed basis at Engineering, Operations, or Maintenance request.

Appendix E, 'Long Term Storage Maintenance Requirements', are those items required to be completed for a sustained non-operational condition of more than one year.

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Nelson, *Parts List and Maintenance Manual for Nelson Trailer No. 4938*, Nelson Manufacturing Company

Stamford, Publication No. BCH-018, *Installation, Service & Maintenance Manual for BC Range of Generators*, 6th Ed., Newage Limited

Thern, *Owner's Manual for Worm/Spur Gear Series 4WS Power Winches*, Thern Incorporated

Webb, Bulletin IM-989, *Installation, Service and Safety Instructions*, Revision 1, Webb Wheel Products Incorporated

APPENDIX A

GENERAL VENDOR PREVENTATIVE MAINTENANCE

Diesel Generator Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
Diesel Engine	Check engine coolant level.	Every 8 hours during operation.
	Charge battery.	Monthly during summer and every 2 months during winter.
	Replace the air cleaner filter element.	Yearly or every 6 cleanings.
	Replace battery.	Every 2 years.
	Replace fuel pipes and clamp bands. Bleed system.	
	Replace radiator hoses and clamp bands.	
	Replace engine coolant.	
	Change engine oil.	After first 50 hours of operation and every 150 hours of operation thereafter.
	Replace the oil filter cartridge.	After first 50 hours of operation and every 300 hours of operation thereafter.
	Inspect/replace/tighten fuel pipes and clamp bands.	Every 50 hours of operation or every 6 months.
	Inspect/clean the air cleaner filter element and housing.	Every 100 hours of operation.
	Check battery electrolyte level.	
	Clean fuel filter.	
	Check fan belt.	
	Inspect radiator hoses and clamp bands.	Every 200 hours of operation or every 6 months.
	Replace fuel filter cartridge. Vent air.	Every 400 hours of operation.
	Replace fan belt.	Every 500 hours of operation.
	Clean engine cooling system.	
	Inspect/Remove sediment from fuel tank.	Every 500 hours of operation.
	Check engine valve clearance.	Every 800 hours of operation.
	Run engine for 5 minutes with no leaks.	Every 2-3 months during periods when the engine is not being operated.
Generator	Inspect/clean air filters.	Every 100 hours of operation or every 3 months.
	Inspect/clean generator interior/exterior.	Every 500 hours of operation or every 3 months.
	Check insulation resistance of windings.	
	Replace generator bearings.	Every 40,000 hours of operation.

APPENDIX A

Hydraulic System Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
Hydraulic System	Check suction strainers.	After the first 10 hours of operation and every 100 hours thereafter.
	Check level of hydraulic fluid.	Every 100 hours of operation
	Check reservoir heater and thermostat	Every 500 hours of operation or every 6 months.
	Replace hydraulic fluid.	Every 1,000-2,000 hours of operation.
	Visual inspection of pump motors.	Every 500 hours of operation or every 3 months.
	Check insulation resistance of pump motor windings.	
	Check tightness of electrical connections.	
	Clean hydraulic system components.	Every 6 months.
	Sample and visually check hydraulic fluid.	
	Inspect reservoir heater and thermostat.	
	Check motor cleanliness and vent/drain openings.	
	Check tightness of electrical connects on motor.	
	Check operation of all manual valves.	
	Clean/check/replace fluid filters	As indicated by CLOGGED FILTER alarm
Hydraulic Cylinders (Transport Trailer strap latch mechanism)	Check rod seals for leakage.	Every 12 months

Electrical and Control Systems Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
IR Remote Controls	Charge batteries.	Every 8 hours of operation (when discharged).
Enclosure Heat Exchangers	Inspect and clean air filters.	Monthly during operation.
Electrical Components and Enclosures	Inspect and clean electrical components, connections, and wiring.	Every 6 months during operation.
Circuit Breakers	Check operation.	
Cable Reel	Lubricate.	
Shore Power Cable	Inspect cable, plugs, connectors, and receptacles.	Yearly during operation.

APPENDIX A

Slide and Outrigger Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
Actuator Motors	Visual inspection.	Every 500 hours of operation or every 3 months during operating periods and every 6 months otherwise.
	Check insulation resistance.	
	Check tightness of electrical connections.	
	Rotate motor shaft.	Every 2 months during periods when the motor is not operated.
Horizontal Slides	Lubricate slides.	Monthly during operation.
Gear Actuators	Lubricate actuator and gear box.	
Bellows boots	Visual inspection.	Monthly during operating periods and every 6 months otherwise.
	Check screw thread lubrication and cleanliness.	Every 6 months during periods of operation.
	Check lifting screw backlash.	
Speed Reducers	Replace lubricating oil.	Every 6 months during operation.

Strongback Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
Skid Lower Guide Wheels	Lubricate.	Monthly during operation.
Latch Mechanism	Lubricate.	
Latch Motors	Visual inspection.	Every 500 hours of operation or every 3 months (during periods operation
	Check insulation resistance.	
Strongback Electrical Assembly	Inspect electrical connections and wiring.	

Trailer Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
Tires	Visual inspection.	Daily during operation
	Check air pressure.	
Hubs	Visual inspection.	
	Check capnut and/or flange nut torque.	After first 50-100 miles and every 2000-4000 miles thereafter.
	Replace bearing lubricant.	Every 25,000 miles.
Wheels	Visual inspection.	Daily during operation.
	Check rim nut torque.	After first 50-100 miles and every 2,000-4,000 miles thereafter.
Undercarriage Lock Mechanism	Lubricate.	Lubricate every 6 months during operation.
Landing Gear (trailers and personnel access platform)		

APPENDIX A

Tug Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
Actuator Motor	Visual inspection.	Every 500 hours of operation or every 3 months during operating periods and every 6 months otherwise.
	Check insulation resistance.	
	Check tightness of electrical connections.	
	Rotate motor shaft.	Every 2 months during periods when the motor is not operated.
Tug Wheels	Lubricate.	Monthly during operation.
Gear Actuator	Lubricate actuator and gear box.	
Bellows Boots	Visual inspection.	Monthly during operating periods and every 6 months otherwise.
	Check screw thread lubrication and cleanliness.	Every 6 months during operating periods.
	Check screw backlash.	
Speed Reducer	Replace lubricating oil.	Every 6 months during operation.

Tug Winch Preventative Maintenance

Component/Part	Maintenance Action	Vendor Recommended Frequency
Winch Assembly	Detailed inspection.	After the first 10 hours of operation and every 6 months during periods of operation.
	Check electrical connections and wiring.	
	Check winch drum.	Every 6 months during operating periods.
	Check winch foundation.	
	Load test at 10% design load.	
	Clean winch assembly components.	Every 6 months
Winch	Sample and visually check reducer lubricant.	After first 5 hours of operation and every 6 months during periods of operation.
	Rotate winch drum.	Every 2 months during periods when the winch is not operated.
	Replace reducer lubricant.	Every 2 years
Motor	Visual inspection.	After the first 10 hours of operation and every 500 hours of operation or every 3 months during periods of operation.
	Check insulation resistance.	
Wire Rope	Visual inspection.	According to Section 8.0 of the Hanford Site Hoisting and Rigging Manual.
	Lubricate sheaves.	

APPENDIX B

PRE-USE MAINTENANCE

Diesel Generator Pre-Use Inspection

Component/Part	Maintenance Action
Diesel Engine	Visual Inspection. Check for overall condition and damaged, loose or missing parts.
	Check engine coolant level.
	Check engine fuel level.
	Check engine oil level.
	Inspect the air cleaner filter element, filter housing, and cap. Clean, if necessary.
	Check battery electrolyte level and charge.
Generator	Inspect air filters. Clean and charge if necessary.

Hydraulic System Pre-Use Maintenance

Component/Part	Maintenance Action
Hydraulic System	Valve inspection. Check for damage, missing parts, and leakage.
	Inspect filters
	Check level of hydraulic fluid.
Hydraulic Cylinders (Transport Trailer strap latch mechanism)	Check vented spring side of hydraulic cylinders free of dirt and debris.

Electrical and Control Systems Pre-Use Maintenance

Component/Part	Maintenance Action
IR Remote Controls	Inspect/Recharge/Replace batteries.
Enclosure Heat Exchanges	Inspect and clean filters.
Electrical Components	Check and replace light bulbs if necessary. Check operability of cameras.

Trailer Pre-Use Maintenance

Component/Part	Maintenance Action
Tires	Check tire pressure.
	Visual inspection.
Hubs, Wheels, and Undercarriage	Visual inspection.

APPENDIX B

Tug Pre-Use Maintenance

Component/Part	Maintenance Action
Tug Wheels	Check and clean wheel track.
Bellows Boots	Visual inspection.
Speed Reducer	Check breather plug installed.

Tug Winch Pre-Use Maintenance

Component/Part	Maintenance Action
Winch Assembly	Visual inspection.
	Check reducer lubricant level.
Winch	Lubricate spur gears.
	Lubricate flange bearings.
	Check reducer lubricant level.
Motor	Check motor cleanliness.
Wire Rope	Pre-use maintenance according to Hanford Site Rigging and Hoisting Manual.

APPENDIX C

SIX MONTH PREVENTATIVE MAINTENANCE REQUIREMENTS

Diesel Generator 6 Mo. Maintenance

Component/Part	Maintenance Action
Diesel Engine	Check/Recharge battery electrolyte level.
	Change engine oil.
	Clean/replace the oil filter cartridge.
	Inspect/clean/replace the air cleaner filter element and clean housing.
	Clean/replace fuel filter.
	Check/replace fan belt.
	Inspect/clean engine cooling system.
	Inspect for/remove sediment from fuel tank.
	Run engine for 5 minutes with no leaks.
Generator	Inspect/clean air filters.
	Inspect/clean generator interior/exterior.
	Check insulation resistance of windings (initial inspection).

Hydraulic System 6 Mo. Maintenance

Component/Part	Maintenance Action
Hydraulic System	Check suction strainers.
	Check level of hydraulic fluid.
	Check reservoir heater and thermostat
	Visual inspection of pump motors.
	Check insulation resistance of pump motor windings (initial inspection).
	Check tightness of electrical connections.
	Clean hydraulic system components.
	Sample and visually check hydraulic fluid.
	Check motor cleanliness and vent/drain openings.
	Check tightness of electrical connects on motor.
	Check operation of all manual valves.
	Clean/check/replace fluid filters
Hydraulic Cylinders (strongback cylinders, strap latch mechanism, trailer bogeys)	Check rod cylinders for leakage.

APPENDIX C

Electrical and Control Systems 6 Mo. Maintenance

Component/Part	Maintenance Action
Enclosure Heat Exchangers	Inspect and clean air filters.
Electrical Components - lights - cameras - limit switches - electrical cabinet, etc.	Inspect/tighten and clean/replace electrical components, connections, and wiring.
Circuit Breakers	Check operation.
Cable Reel	Lubricate.
Shore Power Cable	Inspect cable, plugs, connectors, and receptacles.

Slide and Outrigger 6 Mo. Maintenance

Component/Part	Maintenance Action
Actuator Motors	Visual inspection.
	Check insulation resistance (initial inspection).
	Check tightness of electrical connections.
	Rotate motor shaft.
Horizontal Slides	Lubricate slides.
Gear Actuators	Lubricate actuator and gearbox.
Bellows boots	Visual inspection.
	Check screw thread lubrication and cleanliness.
	Check lifting screw backlash.
Speed Reducers	Inspect/replace lubricating oil.

Strongback Preventative 6 Mo. Maintenance

Component/Part	Maintenance Action
Skid Lower Guide Wheels	Lubricate.
Latch Mechanism	Lubricate.
Latch Motors	Visual inspection.
	Check insulation resistance (initial inspection).
Strongback Electrical Assembly	Inspect electrical connections and wiring.

Trailer Preventative 6 Mo. Maintenance

Component/Part	Maintenance Action
Tires	Visual inspection.
	Check air pressure.
Hubs	Visual inspection.
Wheels	Visual inspection.
Undercarriage Lock Mechanism	Lubricate as required.
Landing Gear (trailers and personnel access platform)	

APPENDIX C

Tug Preventative 6 Mo. Maintenance

Component/Part	Maintenance Action
Actuator Motor	Visual inspection.
	Check insulation resistance (initial inspection).
	Check tightness of electrical connections.
	Rotate motor shaft.
Tug Wheels	Lubricate.
Gear Actuator	Lubricate actuator and gearbox.
Bellows Boots	Visual inspection.
	Check screw thread lubrication and cleanliness.
	Check screw backlash.
Speed Reducer	Replace lubricating oil.

Tug Winch 6 Mo. Maintenance

Component/Part	Maintenance Action
Winch Assembly (per applicable Hanford Hoisting and Rigging manual)	Check electrical connections and wiring.
	Check winch drum.
	Check winch foundation.
	Load test at 10%rated capacity, if required by Hoisting and Rigging manual.
	Clean winch assembly components.
Winch Assembly (per applicable Hanford Hoisting and Rigging manual)	Sample and visually check reducer lubricant.
	Rotate winch drum.
Motor	Visual inspection.
	Check insulation resistance (initial inspection).
Wire Rope	Visual inspection.
	Lubricate sheaves.

APPENDIX D

UPON REQUEST MAINTENANCE

Diesel Generator Recall Maintenance

Component/Part	Maintenance Action
Diesel Engine	Replace battery.
	Replace fuel pipes and clamp bands. Bleed system.
	Replace radiator hoses and clamp bands.
	Replace engine coolant.
	Check engine valve clearance.
	Run engine for 5 minutes with no leaks.
Generator	Replace generator bearings.

Hydraulic System Recall Maintenance

Component/Part	Maintenance Action
Hydraulic System	Replace hydraulic fluid.

Trailer Recall Maintenance

Component/Part	Maintenance Action
Hubs	Check capnut and/or flange nut torque.
	Replace bearing lubricant.
Wheels	Check rim nut torque.

Tug Winch Recall Maintenance

Component/Part	Maintenance Action
Winch	Replace reducer lubricant.

APPENDIX E

LONG TERM STORAGE MAINTENANCE REQUIREMENTS

Diesel Generator Preventative Maintenance

Component/Part	Maintenance Action
Diesel Engine	Remove battery.
	Drain fuel.
	Change engine oil.
	Drain engine cooling system.