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EGG-WM-8509
April 1989

INFORMAL REPORT

FUNCTIONS AND DESIGN REQUIREMENTS FOR THE RDP SUPERVISORY SYSTEM CONTROL STATION OF THE RETRIEVAL DEMONSTRATION PROJECT BURIED WASTE PROGRAM

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EG&G Idaho

Work performed under
DOE Contract
No. DE-AC07-76ID01570

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REVIEWED BY:

SAFETY		DATE 4-24-89
QUALITY		DATE 4-25-89
ENGINEERING		DATE 4-25-89
PROJECT MANAGEMENT		DATE 5-24-89
COST ACCOUNT MANAGER		DATE 5/31/89

APPROVED
DATE 6/1/89
BWP MANAGER

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FUNCTIONS
AND
DESIGN REQUIREMENTS

for the

RDP SUPERVISORY SYSTEM
CONTROL STATION

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SUMMARY

This document is the functions and design requirements section of the System Design Description (SDD) for the Retrieval Demonstration Project (RDP) Supervisory System Control Station of the Buried Waste Program.

The RDP Supervisory System Control Station is part of the RDP Computer System and is responsible for monitoring and coordinating the activities of individual control stations, and communicating process control information to a supervisory operator and host computer. The Supervisory System Control Station consists of a control processor, programmable logic controller, and operators display system.

The scope of the Supervisory System Control Station is based on the buried waste project retrieval demonstration requirements workscope[1] and subsequent design studies. The objective of which, is to prove the feasibility of remotely and automatically exhuming buried waste in the Retrieval Demonstration Project and subsequently in a production phase.

The Supervisory System Control Station will be designed using commercially available state-of-the-art hardware and software. The control station controls, monitors, data displays, and status indicators will be based on the latest human engineering criteria and operational requirements. Network communication software will be Government OSI-compliant.

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[1] J. M. Bower, Workscope for the Retrieval Project of the Buried Waste Program, Informal Report EG&G-WM-8386.

ACRONYMS

ANSI	American National Standards Institute
BWP	Buried Waste Program
CCS	Contamination control System
CCTV	Closed Circuit Television
CSS	Contamination Suppression System
EEPROM	Electrically Eraseable Programmable Read Only Memory
EIA	Electronics Industries Association
FIP	Federal Information Processing
GOSIP	Government Open System Interconnection Profile
IEEE	Institute of Electronics and Electrical Engineers
INEL	Idaho National Engineering Laboratory
LAMS	Lift and Manipulation System
LAN	Local Area Network
LLW	Low Level Waste
MTTR	Mean-time-to-Repair
OSI	Open System Interconnection
PID	Proportional Integral Derivative Control
PLC	Programmable Logic Controller
RAM	Random Access Memory
RDP	Retrieval Demostration Project
SDD	System Design Description
TRU	Transuranic
VMS	Virtual Memory System

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FIGURES

1.0 FUNCTIONAL AND DESIGN REQUIREMENTS

The objective of this Functional and Design Requirements Document is to provide a description of required functions and operation, and to define design requirements for the Retrieval Demonstration Project (RDP) Supervisory System Control Station.

1.1 Functional Performance Requirements

The Supervisory System Control Station can be defined as a cell controller, the purpose of which is to:

- o coordinate and supervise independent process control devices that handle machine or process input/output (I/O)
- o communicate process control information with a supervisory operator, process devices, and host computer system.
- o locally store, retrieve, and display process control information
- o provide mathematical and logical calculations required to determine system level interlocks based on the status and position of robotic and process equipment

1.1.1 Operation

The RDP Supervisory System Control Station will operate in a supervisory mode to monitor and coordinate station level devices and receive information from the following control stations:

- o Excavator
- o Contamination Control System (CCS)
- o Waste Transport System
- o Hazards Monitoring Systems
- o Separation and Pass-out systems
- o Separation Manipulators

Each control station will be linked to the supervisory system, but the supervisory system is not part of the individual control systems.

1.1.2 Control

The supervisory control system will be responsible for controlling process equipment on a supervisory basis. A control panel will be provided to allow an operator to manually activate and override interlocks and alarms. The system will also provide the operator with the ability to perform manual and/or automatic lockout of all control stations. The operator will not be allowed to override interlocks and alarms without obtaining the facility managers approval, where specified in the operating procedures. The supervisory operator will be able to view the overall retrieval, separation, and pass-out processes from the supervisory system control station color graphics display and CCTV monitors.

The supervisory control station will be able to access the CCTV node and perform automatic camera switching based on process status and interlock conditions. The supervisory control station operator shall be capable of manually selecting CCTV cameras for viewing at his station. Manual camera selection and control (pan, tilt, and zoom) will be performed by the operator at the individual control station, through switching circuitry interfaced directly to the CCTV control node.

1.1.3 Supervisory Level Interlocks/Permissives

The system will monitor the entire retrieval process and lockout retrieval operations which are out of sequence or must wait for other processes to be completed. Permissives and positioning information will be used to calculate system level interlocks to inhibit out-of-sequence retrieval operations.

The supervisory control system will prevent collision of equipment controlled by the individual control stations. The system will receive permissives and positioning information relative to the location of all remotely controlled vehicles from the control stations. The position information will be derived from the coordinate position system provided with each piece of remotely controlled mobile equipment. The supervisory control computer will establish blocking zones and use the coordinate information to

continually monitor the location of all mobile process equipment. A collision-alert signal will be sent to the individual control stations indicating any violation of blocking zones or possible collisions. The response time for the supervisory system and individual control stations shall be sufficient to provide equipment protection when operating at maximum specified component velocities.

The coordinate position information for each excavated shovel load will be transmitted to the host computer system for material tracking and traceability control (see section 1.1.6). Material transfer will be unsolicited and initiated by the operator or when the shovel load subsequently enters the next control zone.

1.1.4 Monitoring and Status Display

The system will provide standard interfaces for monitoring the several operator control stations and will allow operator assisted and automatic supervision of the overall retrieval process. A color graphics display system will be provided for displaying, to the supervisory level operator, the status of the overall retrieval process and equipment.

1.1.5 Data Reporting and Alarm

A log printer will be provided to permanently report out-of-sequence events or alarms to the operator. Material tracking and inventory reports will be printed by the host computer system (see Figure 2).

1.1.6 Material Tracking and Traceability

The host computer will be used to maintain material tracking and traceability functions throughout the process. The supervisory control station will monitor the location of each shovel load or batch, and convey this information to the host computer.

Tentatively, seven process areas of tracking are identified:

- excavation and dumpster loading; including, manipulation of items in the dumpster and positioning of special case (large or odd shaped) items near the dig face
- dumpster transporting
- dumpster unloading
- separation
- fissile inventory monitoring/criticality avoidance
- pass-out
- interim storage

Data accumulated during the excavation and dumpster loading process includes:

- X, Y, Z coordinates of each shovel load
- position of special case items
- time of excavation
- barcode of dumpster used
- hydrocarbon vapor released
- gamma radiation levels

Data conveyed during the dumpster transporting process includes:

- barcode of dumpster in use
- X, Y, Z coordinates of the dig face where the load was retrieved
- dumpster weight

Data conveyed during the dumpster unloading process includes:

- barcode of dumpster being processed
- X, Y, Z coordinates of the dig face where the load was retrieved
- time of dump

Data conveyed during the separation process includes:

- separated batch identification
- X, Y, Z coordinates of the dig face where the load was retrieved
- extent of toxic gases released during processing

Data conveyed during the fissile inventory monitoring and criticality avoidance process includes:

- o fines/intermediates/intact batch identification
- o fissile material content of storage container
- o weight
- o identification of waste type (LLW or TRU)

Data conveyed during pass-out will be used to generate a barcode identification for the final interim storage container. The data has not been determined yet, but may include the following:

- o separation batches
- o identification of vertical slice of dig face from which the product originated
- o hydrocarbon vapor and toxic gas inventory
- o fissile material content
- o container identification number

Data conveyed for interim storage will include:

- o container identification number
- o container location

1.2 Design Requirements

1.2.1 Hardware

This section describes the devices needed in and accessed by the RDP Supervisory System Control Station. The hardware will consist of three main items; the Programmable Logic Controller (PLC) system, Cell Control Processor, and Operators Display System. A system block diagram is shown in Figure 1.

1.2.1.1 Programmable Logic Controller. A Programmable Logic Controller system shall perform control and logic functions, and provide the input/output (I/O) interface to condition the various signals received from and sent to the control stations. The I/O logic shall provide fail-safe

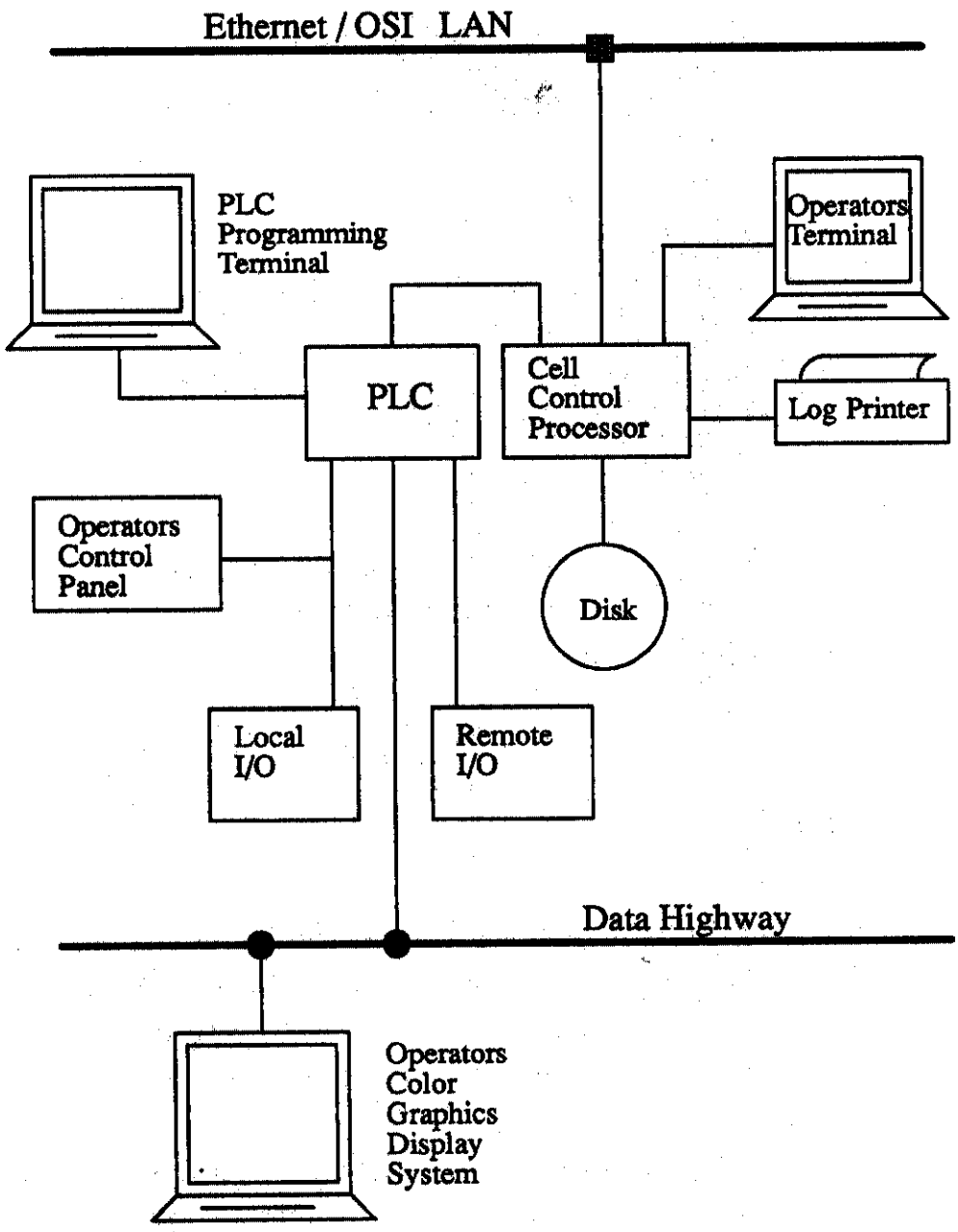


Figure 1 – RDP Supervisory System Control Station Block Diagram

operation and orderly shutdown in the event of a problem. The PLC will interface to a high-level or Cell Control Processor described in Section 1.2.1.2, and an Operators Display and Panel described in Section 1.2.1.3.

The features of the PLC shall include the following:

- 32-bit microprocessor technology
- Memory Capacity - The base memory shall be 16 K words, minimum; battery backed up, capable of expansion with RAM and EEPROM.
- I/O Capacity - The PLC shall accommodate a variety of inputs and outputs and communication interfaces (see Section 1.4), up to 1024 discrete I/O (the exact number is yet to be determined), in any mix of 8, 16, or 32-points and intelligent modules, located locally or remotely up to 10,000 feet away.
- Communications - The PLC shall incorporate local and remote I/O communication scanners, and shall be capable of communicating with other PLC processors over a peer communications link or data highway. The PLC shall communicate with the cell control processor and the cell control processor shall have access to the PLC's data table, over a common backplane or the peer communication link. Intelligent modules shall be available for local and remote ASCII I/O.
- Programming - Programming and control of I/O functions shall be performed in Boolean or ladder diagram logic with structured sequential function chart capability, or directly from the cell control processor using standard "C" and/or Fortran languages. The PLC shall be programmable with ladder logic development software running on a programming terminal, IBM-AT or compatible computer. Programming support shall include; fault routines, selectable timed interrupt, subroutine programming, I/O forcing, and ladder logic searching in both online and offline modes, and upload/download of data and program files.

- o Program Scan - The PLC shall provide for sequential scan of all I/O at a typical rate of 2 mS/K words (bit logic).
- o Instruction Set - The instruction set shall include; relay-type, time and counter, math, data conversion, diagnostics, shift register, comparisons, data transfer, sequencer, intermediate I/O program control, and PID control.

1.2.1.2 Cell Control Processor. A cell control processor shall provide an interface between the PLC and the host computer residing on the Local Area Network (LAN). The processor shall access the PLC data table directly and convert PLC data to a format compatible with the host operating system. The processor shall be designed to operate with a disk.

The features of the cell control processor are:

- o 32-bit computer
- o VMS or equivalent operating system
- o 8 megabytes of RAM
- o local interface for a Winchester-type hard disk
- o Ethernet communication port using Open System Interconnection (OSI) standard communication software
- o four RS232 ports, minimum

1.2.1.3 Operators Display System. An Operators Display System shall present real-time process information to the supervisory operator, in the form of color graphic displays depicting the status of the overall retrieval process. The system will also provide a control panel for operator interface with the process and equipment. The Operators Display System will interface with the PLC or cell control processor. The hardware shall feature the following:

- o DEC VAX workstation, IBM XT/AT, or equivalent
- o 19" high-resolution color graphics monitor (1024 x 864 pixals)
- o 16 colors, minimum
- o standard IBM compatible keyboard and industrial control panel
- o mouse-selection of on screen objects

1.2.2 Software

1.2.2.1 Programmable Logic Controller. The PLC will be programmed using Boolean or ladder logic diagram language and sequential function chart techniques using a software development package; such as, ICOM Ladder Logistics, which runs under VMS or an MS-DOS environment. The software shall allow online and offline programming, documentation, and troubleshooting from a program development system or terminal connected to the cell control computer or PLC. PLC programs shall be capable of being downloaded and uploaded from the program development system and/or cell control computer.

1.2.2.2 Cell Control Processor. The Cell Control Processor's operating system shall be VMS or equivalent. Application programs shall be developed in "C" or FORTRAN languages. The Cell Control Processor will communicate with the host computer and other nodes on the Ethernet local area network (LAN).

1.2.2.3 Operators Display System. The Operators Display System shall use a high level graphics based programming language, designed to interface with PLC's, that provides real-time operation, build, and edit of process application screen graphics.

1.3 Operational Requirements

This section covers the requirements for operation of the RDP Supervisory System Control Station and describes the operation scenarios associated with station level devices.

1.3.1 Supervisory System Control Station Operation

The Supervisory Control Station will monitor and coordinate station level devices listed in Section 1.1.1. Operation of process systems and equipment will be performed locally at separate operation consoles, independent of the supervisory control station. The supervisory control station will provide the operator with alarms, status, messages, flow diagrams

and other process information needed to monitor the overall retrieval process. Operation of the supervisory station will be automatic and will not require a full time operator. Operator training will be provided by the application programmers. Computer related operation, such as periodic backup of system software, will be performed by the system programmers or the host computer system operator. Operation manuals will be provided by the equipment suppliers. Technical training and support shall be available from the computer equipment suppliers.

1.3.2 Excavator Operation

The Excavator control system will contain an excavator control computer that will be interfaced to control processors located in the excavator over hardwired, fiber optic, or a radio link. The excavator control computer will be located in the main control room and will communicate with the supervisory control computer over the LAN. The excavator control computer will control the operation of the excavator system and monitor interlock signals supplied from the supervisory control system. The location of the excavator and XYZ coordinates of the bucket, retriever, and grappler device will be communicated to the supervisory control system. The supervisory computer will continually survey the position of all mobile process equipment in the retrieval area and alert the excavator control computer of any violation of blocking zones or possible collision conditions. If a collision is eminent or an out-of-sequence operation is performed, a "collision-alert" signal is sent to the excavator control computer to abort operations. The excavator operator will have the capability to override any such signal.

1.3.3 Contamination Control System (CCS) Operation

The CCS Control Station will contain a CCS control computer that will be connected to the lift and manipulation system (LAMS), contamination suppression system (CSS), and other process controls over discrete I/O or the PLC data highway link. The CCS control computer will be located in the main control room and will communicate with the supervisory control computer.

Interface requirements are discussed in Section 1.4.1.2. The CCS control computer will control the operation of the contamination control system and monitor interlock signals supplied from the supervisory control system. The XYZ positioning coordinates for the crane, telemast, and manipulator will be communicated to the supervisory control system. The supervisory computer will continually survey the position of all mobile process equipment and will alert the CCS control computer of any violation of blocking zones or possible collision conditions. If a collision is eminent or an out-of-sequence operation is preformed, a "collision-alert" signal is sent to the CCS control computer to abort operations. The CCS control station operator will have override capability.

The operation of the CCS will be depicted on a color graphics display located at the supervisory control station.

1.3.4 Waste Transport System Operation

The Waste Transport System Control Station will contain a landbase computer that will communicate with the transport vehicles using a 2-way radio link. The landbase computer will be a MicroVax or equivalent, running VMS or ULTRIX operating system. The standard landbase computer will communicate with a supervisory computer over Ethernet. The landbase computer can accept tasks for routing vehicles from the supervisory computer. The landbase computer will accept task initiation requests from the supervisory computer and will control all vehicle movements, monitor positions, and police zones. As a prerequisite to system operation, all vehicle routing tasks and blocking zones shall have been established.

1.3.4.1 In-containment Task. The supervisory computer sends a "task initiate" signal to the landbase computer. The landbase computer assigns and routes a selected vehicle with empty dumpster to the fill station funnel. The vehicle will insert the empty dumpster into the fill station funnel and withdraw from the dumpster. When a "load ready" or "removal permit" is received, the vehicle retrieves the loaded dumpster. A bar code reading identifing the dumpster-in-use is sent to the host computer. The vehicle

proceeds to the tunnel entrance, waits for any vehicle in the tunnel, and then enters the tunnel.

1.3.4.2 In-tunnel Task. The vehicle enters the tunnel and transports the loaded dumpster through the tunnel to the dumpster lift elevator. A "dumpster unload permit" is sent from the supervisory computer. The "dumpster unload permit" is developed from the logical AND of the dumpster lift elevator and turntable positioning signals, and an operator permissive. The lift elevator and turntable operation is locked-out by the supervisor during the vehicle load/unload process. The vehicle automatically deposits the loaded dumpster in the filled dumpster position of the lift mechanism; withdraws, and waits for the filled dumpster to be lifted to the dumping area. The barcode of the dumpster is again transmitted to the host computer when it is placed into the lift mechanism. The turntable is positioned and any empty dumpster is removed from the empty dumpster position of the lift mechanism. The vehicle transports the empty dumpster through the tunnel, and to a home base or empty dumpster storage zone in the containment area.

1.3.4.3 Collision Avoidance Task. The X-Y positioning coordinates for all vehicles is communicated to the supervisory computer. The supervisory computer is continually surveying the position of all mobile process equipment and alerts the landbase computer of any violation of blocking zones or possible collisions. If a collision is eminent, a "collision-alert" signal is sent to the affected vehicles to stop operation. The operator will have override capability.

1.3.5 Fissile Inventory System Operation

After separation, the fines will be passed through: 1) a gamma detector, 2) a fissile inventory monitor, and 3) weigh scales. Data generated by these devices will be transmitted to the host computer via the local area network. The supervisory control system will interface to the separation and pass-out control system. The separation and pass-out control system will interface to the fissile monitoring system PLC which will directly control fissile monitoring conveyors, packaging, and intact barrel functions. When a batch of

fines waste material is in position to be monitored and the fissile monitoring system is ready, a signal will be sent from the separation and pass-out control system to the supervisory control station. A signal will be sent to the fissile monitoring system to initiate the measurement. When the measurement is completed, the fissile monitoring computer will classify the waste batch as either low level mixed waste (LLW/mixed) or transuranic mixed waste (TRU/mixed). A flag will be sent to the supervisory PLC, which will transmit the necessary control outputs to the separation and pass-out control system and the LLW/TRU conveyor will be activated to route the batch to the proper container loading station. The supervisory PLC will keep track of all fissile batches to determine if they can be added to the container without exceeding the fissile material and radiation limits for a particular container. When a limit is exceeded, the supervisory PLC will lockout any further loading until a new container is in position. The container will be sealed when a predetermined fissile inventory or gamma radiation value is reached or it is full by volume.

Waste material not passing through the vibrating screen will be routed by conveyor, through a gamma and fissile inventory monitor to a storage container loading station. The fissile inventory system will monitor the gamma radiation and total fissile mass delivered to the container. As for fines, a flag will be transmitted to the supervisory control station if limits are exceeded. This flag will lockout any further container loading until a new container is in position. Containers with excessive gamma radiation will receive special handling. Radiation data will be transmitted directly to the host computer.

Intact drums will be measured for fissile inventory after being placed in an overpack container. The intact drum monitoring system determines the radiation characteristics and the amount of fissile material in the container. The supervisory control station is alerted if the quantity of fissile material exceeds a predetermined limit. The overpack container is then labeled as "remote handle" and transported to special storage.

Additional information to be sent to the supervisory control station from the radiation monitoring system consists of fissile inventory data, equipment status, interlocks, and alarms.

1.3.6 Separation and Pass-out System Operation

The operation of the separation and pass-out system will be controlled by a PLC. The PLC will be located in the control room with a remote fiber optics or hardwired link connecting the equipment in the separation and pass-out area. The separation and pass-out PLC will connect to the supervisory PLC over a peer-to-peer data highway link. The supervisory control PLC will monitor and coordinate the activities of the separation and passout system over the data highway link. One of the functions of the supervisory control PLC will be to track material as it moves through the separation and pass-out system, and transmit this information on to the host computer (see section 1.1.6).

1.3.7 Separation Manipulator Operation

The separation manipulator control system will contain a control computer located in the main control room or separation area operating gallery. The manipulator control computer will furnish baseline control or interface to individual processors located on the manipulators which will perform local control. The manipulator control computer will convey end effector position information to the supervisory control computer over the LAN. The supervisory control computer will monitor the position of the dumpster and other moving equipment during the dumpster unloading process. If an interference condition or out-of-sequence operation is encountered by the supervisory computer, a "collision-alert" signal will be sent to the manipulator control computer to abort operations. The manipulator operator will have the capability to override any such signal.

1.4 Interface Requirements

1.4.1 Control Stations

The communication interfaces to the RDP supervisory control system shall be as follows:

- a standard IEEE 802.3/Ethernet local area network using communications software conforming to Open System Interconnection (OSI) and Government OSI procurement standards, or Government Open System Interconnection Profile (GOSIP)

- a standard data highway link for PLC's and/or dedicated mini/microcomputers interfacing to the supervisory control station PLC. The data highway link shall be a multi-port communication network providing a data transfer path for up to 64 PLC's and/or mini/microcomputers. The communicating stations shall be distributed anywhere along a single bus that extends a maximum of 10,000 cable feet in length. Data highway protocol shall meet EIA RS-232-C electrical standards and ANSI standard communication protocols.

- discrete input/output (I/O)
  standard ratings:

Input	Output
24 Volts AC/DC	12-48 Volts AC
48 Volts AC/DC	120 Volts AC
120 Volts AC/DC	12-48 Volts DC
TTL level	120 Volts DC
Non-Voltage (Contact Closure)	Contact (relay)
Isolated	Isolated
	TTL level

- numerical data I/O - consisting of analog or multi bit I/O;
  standard ratings:

Input	Output
4-20 mA	4-20 mA
0 to +1 Volts DC	10-50 mA
0 to +5 Volts DC	0 to +5 Volts DC
0 to +10 Volts DC	0 to +10 Volts DC
1 to 5 Volts DC	+/-2.5 Volts DC

+/-5 Volts DC	+/-5 Volts DC
+/-10 Volts DC	+/-10 Volts DC

- ASCII I/O - standard RS-232-C or RS-422 communication link

The cell control computer shall interface to Ethernet and use standard OSI communication software. The interface between the cell computer and the supervisory PLC shall be an internal chassis backplane or RS-232-C interface. Backplane communication software shall be integral and essentially transparent to the operation of the cell computer and supervisory PLC.

1.4.1.1 Excavator Control Station. The physical interface to the excavator control system shall be Ethernet or any combination of interface types listed in section 1.4.1. Communication software provided shall conform to OSI or ASCII standards specified herein. Information to be supplied to the supervisory control station has not been finalized yet, but may include the following data in raw or engineering unit converted parameters:

- motor temperature
- motor amperage
- hydraulic oil pressure
- spray tank level
- radiation levels at the excavator boom
- absolute position coordinates of the excavator base
- position coordinates of the excavator end effector relative to the excavator base
- coordinate position of each waste payload. This information will be retransmitted to the host computer system for use in material tracking and traceability.
- running/spraying/loaded/dumping status
- gamma levels from bucket sensors

1.4.1.2 Contamination Control System (CCS) Control Station. The CCS control station will be a remotely operated control console located in the control room. Hardwired interconnections will be provided between the CCS

control console and robotic equipment located in the excavation pit. Signals required by the supervisory control station will be routed through the control console. The physical interface for the CCS control station shall be a standard PLC data highway or Ethernet. Communication software provided shall conform to data highway protocol used by the supervisory PLC or, if connected to Ethernet, OSI standards specified herein. Information to be supplied to the supervisory control station has not been finalized at this time, but may include the following:

- o absolute positioning coordinates of CCS support structure base
- o crane, telemast, and manipulator positions relative to a baseline reference to establish interlock signals with other equipment in the vicinity
- o operational status of equipment; including position of ancillary tools
- o numerical data

Operational status (running/off) signals will be provided for the following equipment:

- o bridge crane
- o telemast
- o manipulator and end effector
- o mist system
- o fixant sprayer
- o dust suppressant system
- o vacuum
- o spray valve open/closed
- o mist valve open/closed
- o dust suppressant valve open/closed

Numerical data to be provided will include the following in raw or engineering unit converted parameters:

- o spray tank liquid level (fixant, misting, dust suppressant)
- o vacuum differential pressure
- o fixant temperature

- o fixant flow
- o misting temperature and flow
- o dust suppressant temperature and flow

The supervisory control station shall provide interlock signals which shall include the following:

- o motion inhibits for any or all degrees of freedom
- o emergency shutdown
- o general purpose

1.4.1.3 Waste Transport System Control Station. The physical interface for the Waste Transport System Control Station shall be Ethernet. Communication software provided shall conform to OSI standards specified herein. Information sent to the supervisory station shall include the following:

- o vehicle position in X-Y coordinates and heading angle (continuously updated every 2 seconds or less)
- o XY coordinate of reference (solicitated and updated upon rebase)
- o funnel location
- o dumpster location
- o dumpster identification (unsolicitated)
- o gross weight of dumpster (solicitated at completion of vehicle loading)
- o vehicle loaded flag
- o operator collision alert override
- o vehicle enable by operator
- o vehicle in load/unload process

Operational status information supplied for each transport vehicle will include the following:

- o diagnostic fail detect
- o assistance request/loss of positioning
- o obstacle detect/E-stop
- o ready or idle

- o loaded/unloaded
- o lifting/lowering
- o lift up/down
- o travel speed
- o forward/reverse
- o task completed

The supervisory computer will send the following information to the landbase computer (see operation scenario Section 1.3.4):

- o blocking zone assignments
- o task initiation request
- o collision alert flag (collision possible with other plant equipment)
- o flag to inhibit vehicle operation during dumpster loading
- o loaded dumpster ready flag
- o loaded dumpster removal permit at loading area
- o dumpster unload permit at separation area
- o empty dumpster retreival permit at separation area

1.4.1.4 Hazards Monitoring Systems. Hazards monitoring systems will be available for determining fissile inventory, detecting gamma radiation for criticality avoidance, and radioactivity and hazardous gas levels.

1.4.1.4.1 Fissile Inventory System - The physical interface for the Fissile Inventory System shall be via the Ethernet local area network, with the exception of the fissile monitoring system PLC which control waste movement through the fissile monitoring systems. The PLC will interface directly to the separation and pass-out control system.

1.4.1.4.2 Radiation Monitoring Systems - Several independent radiation measurements (20-25) will be taken at the dig face and other pertinent process locations. Results of these radiation measurements will be sent directly to the host computer via an RS-232-C or RS-422 serial data link.

1.4.1.4.3 Hazardous Gases Monitoring System - Gas monitors will detect the presence of toxics and volatile gases. Readouts and/or alarms will be provided in the control room. Hydrocarbon vapor and toxic gas inventories will be sent directly to the host computer via an RS-232-C or RS-422 serial data link.

1.4.1.5 Separation and Pass-out Control Station. The physical interface for the Separation and Pass-out Control Station shall be the PLC data highway. Information to be supplied to the Supervisory Control Station have not been finalized yet. The information will include signals to indicate the position or status of the following equipment:

- o dumpster lift elevator
- o elevator turntable
- o filled dumpster in-place
- o empty dumpster in-place
- o airlock doors
- o enclosure hatch open/closed
- o dumpsters rotated 180 degrees
- o dumpsters returned to the upright position
- o dumpster positions in cleaning and fixant systems
- o fines drum in-place
- o intermediate container in-place
- o intact drum overpack container in-place
- o conveyors

Signals derived from strategically located limit switches and load cells will be used to track batches of waste as they proceed through the process.

Operational status (running/off) signals are required for the following equipment:

- o dumpster lift elevator
- o elevator transveyor and offload conveyors
- o dumpster rotator
- o dumpster cleaning or fixant system on/off

- o vibrating screen
- o cleaning systems
- o gate valve with position (open/closed)
- o fissile monitor conveyor
- o LLW/TRU conveyor with direction status and control
- o intermediate waste conveyor with direction status
- o utilities equipment - pumps, directional control valves, and electric motors
- o manipulator
- o container fill level
- o misting systems on/off
- o ventilation/shroud flow (on/off)

Signals will be provided to establish interlocks to prevent the hatch from opening unless steam cleaning, misting, or fixing systems are off. Other information required is:

- o Signals depicting when personnel are in the excavation or separation area to establish interlock signals to prevent auto/remote operation of any equipment.
- o Dig face gamma high level signal.
- o alarms and interlocks

1.4.1.6 Separation Manipulator Control Station. The Separation Manipulator Control Station will be located in the main control room or separation area operating gallery. The physical interface for the Separation Manipulator Control Station will be Ethernet or ASCII I/O.

Information to be supplied to the supervisory control station has not been finalized yet, but may include the following:

- o manipulator position information to establish interlocks to prevent collision with other equipment.
- o end effector position status

1.4.2 Host Computer

The host computer provides the base computing resources for the RDP retrieval project and will perform plant supervision and data management functions. The conceptual design for the RDP computer system is shown in Figure 2. The host computer will communicate with the supervisory system control station and other nodes, over an IEEE 802.3/Ethernet local area network. The communications software to be provided for the host computer shall contain the protocols required to exchange messages between the various systems connected to the network. The software shall conform to the Government Open System Interconnection Profile (GOSIP) standard.

1.4.3 Operators Display System

The physical connection of the operators display system, as described in section 1.2.1.3, will be over the PLC data highway or ASCII I/O interface.

1.5 Maintenance Requirements

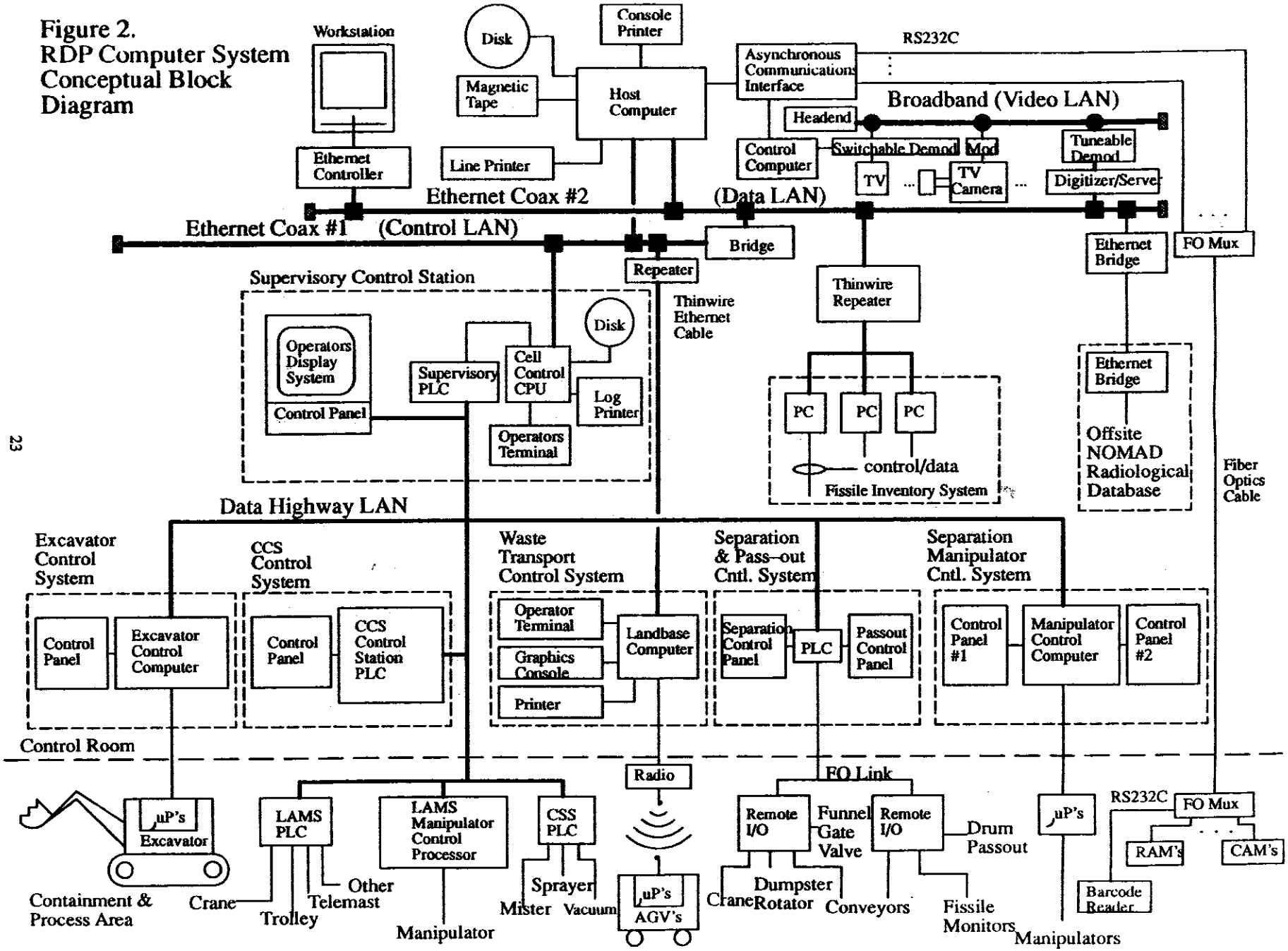
1.5.1 Hardware and Software Maintenance

A hardware and software maintenance program for the supervisory control system shall be developed and documented in accordance with RDP requirements. Maintenance of computer hardware will either be performed in-house or under available site wide computer maintenance contracts. Typical Mean-Time-To-Repair (MTTR) shall be four hours. Software maintenance will be performed in-house.

1.5.2 Spare Parts

Spare parts for computer equipment to be maintained in-house shall be identified, procured, and stored in accordance with standard practices. The initial complement of spare parts will be recommended by the suppliers

Figure 2.
RDP Computer System
Conceptual Block
Diagram



1.6 Environmental Requirements

1.6.1 Operating Environment

The Supervisory System Control Station shall operate reliably and safely in the following control room environment:

- o temperature - 60 degrees to 90 degrees F
- o humidity - 30 % to 70 % relative humidity, non-condensing
- o seismic - The control station is not required to operate during a seismic event.
- o altitude - 5000 feet

1.6.2 Storage Environment

The equipment shall function properly after storage in the following environment for periods of up to one year.

- o temperature - -40 degrees F to +130 degrees
- o humidity - 5 % to 95 % relative humidity, noncondensing
- o altitude - 5000 feet

Inside storage will be provided by the user.

1.7 Fabrication, Shipping, and Installation Requirements

1.7.1 Fabrication

The RDP Supervisory System Control Station shall be fabricated using materials consistent with the environment and operating requirements specified herein. Workmanship shall be of the quality prevailing among manufactures producing equipment of the type specified herein. Defective components, parts, and assemblies which have been repaired to overcome deficiencies shall not be furnished.

1.7.2 Installation

Installation of the supervisory control station shall be performed by the supplier or subcontractor in accordance with installation manuals provided by the supplier and applicable engineering drawings. The supplier shall checkout the equipment after installation to assure there are no operational deficiencies. After installation and checkout, the supplier shall leave the installation in a clean operational state.

1.8 Quality Assurance Requirements

Quality assurance during system design, procurement, documentation, installation, and testing shall be in accordance with QPP-149 "BWP Quality Program Plan". All data gathered and used for making BWP programmatic decisions shall be in accordance with EG&G-WM-8220 "BWP Data Collection QAP".

1.8.1 Level

Quality level for the system and system components is level B with Quality involvement as required.

1.8.2 Inspection

Received items shall be inspected to ensure compliance with ordering documentation. Installation shall be inspected to EG&G Idaho workmanship standards and applicable engineering drawings or wiring schedules.

1.8.3 Acceptance

Acceptance criteria shall be identified and incorporated into acceptance test procedures that are to be successfully performed at the supplier's facility prior to shipment authorization and after installation at the INEL.

1.9 Codes, Standards and References

The following documents of the issue shown shall form a part of this requirements section to the extent specified herein. When an exact issue is not specified, the applicable issue shall be the current issue in force at the date of this document. Additional specific codes and standards may be chosen that apply to the design, construction, and installation of components at the discretion of the system designer, subject to the limitation that management-approved standards shall be used for all components for which applicable standards are available.

- QAP-149
- EG&G-WM-8220
- EG&G Safety Manual
- National Electric Code
- EG&G Standard Practices
- OSI Communication Standard - FIP's publication 146
- IEEE 802.3
- EIA RS-232-C Electrical Standards

1.10 Documentation and Reports

The following documents shall be provided as part of the supervisory system control station:

- acceptance test procedures
- system operational test
- user and technical manuals
- recommended spare parts list
- procurement specification
- system design description
- special maintenance tools list, if required

The supplier(s) shall provide copies of their Quality Assurance Program Plan and inspection procedures. In addition, the supplier(s) shall provide test procedures, test reports, user and technical manuals, recommended spare

parts list, and packing and shipping procedures.

1.10.1 Software Documentation

All ladder diagram application programs developed for the PLC shall be documented to include; instruction descriptions, rung explanations and commentary, and instruction/rung cross references. A software development package shall be supplied for the PLC programming terminal to provide this function.

Application programs shall be documented in accordance with standard programming practices.