DISTRIBUTION SHEET

To	From	Page 1 of 1
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Engineering Task Plan for Flammable Gas Atmosphere Mobile Color Video Camera Systems		ECN No.

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1	1	Safety MN Islam	<i>see Krogsrud/Huckfeldt for</i>		R3-08	LT Pedersen			N1-46	3	
3		Env. SR Tifft			H6-26	DW Strasser			R1-51	3	
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3		EJ Walter			H5-52	RA Huckfeldt	<i>P. C. Huckfeldt</i>	1/19/95	R3-01	1	1

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**This document was reviewed following the
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APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

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7. Abstract

This Engineering Task Plan describes the deliverables and responsibilities on the design and testing of two flammable gas atmosphere safe mobile color video camera systems. The systems will utilize all new components which include such items as the vendor designed and furnished mast, light assembly, manifolds and shield, pan & tilt unit, and camera.

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**ENGINEERING TASK PLAN FOR
FLAMMABLE GAS ATMOSPHERE MOBILE
COLOR VIDEO CAMERA SYSTEMS**

Impact level SQ

Ed Kohlman
January 1995

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ENGINEERING TASK PLAN FOR FLAMMABLE GAS ATMOSPHERE MOBILE COLOR VIDEO CAMERA SYSTEMS

1.0 INTRODUCTION

This Engineering Task Plan (ETP) describes the design, fabrication, assembly, and testing of the mobile video camera systems. The color video camera systems will be used to observe and record the activities within the vapor space of a tank on a limited exposure basis. The units will be fully mobile and designed for operation in the single-shell flammable gas producing tanks.

2.0 SCOPE

2.1 Objective

The objective of this task is to provide two mobile camera systems for use in flammable gas producing single-shell tanks (SSTs) for the Flammable Gas Tank Safety Program. The camera systems will provide observation, video recording, and monitoring of the activities that occur in the vapor space of applied tanks. The camera systems will be designed to be totally mobile, capable of deployment up to 6.1 meters (20') into a 4" (minimum) riser.

2.2 Deliverables

Two remotely operable mobile camera systems will be provided for use in flammable gas SST's. The camera systems will be designed with either a combustible gas interlock safety system or a pressurization (purge) system suitable for use in the flammable gas SST tanks. The deliverables consist of the following major categories.

- 2.2.1 Project supporting documentation including an ETP, procurement specifications, drawings, test plan, structural analysis (where required), As Low As Reasonably Achievable Management Work Sheet, and unreviewed safety question (USQ) screening (where required).
- 2.2.2 Hardware to facilitate the camera system operation in the selected tanks' risers. Camera system will include all optics, maneuvering devices, deployment, and hazardous location features for a complete packaged product.
- 2.2.3 The safety system design for the portable cameras shall be a combustible gas monitoring device which will monitor the tanks' vapor space for combustible hydrogen and, in the event of a hydrogen gas increase, will shut the power systems off if preset hydrogen ppm limits are reached. If a type Z pressurization (purge) gas system is used per National Fire Protection Association (NFPA) 496, the gas will be supplied by a small nitrogen bottle (or compressed air) operated portable system.

- 2.2.4 Zoom video camera, video recorder, monitor, video printer, camera control equipment, and all controls necessary to operate the system. The controls and monitoring devices may be housed in a van or similar vehicle.
- 2.2.5 Electrical lighting fixtures and lights shall, as a minimum, be Underwriters' Laboratories (UL) listed. Lights shall be suitable for the environmental and radiological conditions encountered in the tank's vapor space.
- 2.2.6 Installation work plan and operating and maintenance procedures as required.

3.0 DESCRIPTION

3.1 Physical Description

The mobile camera system will include all components required to observe and record activities within the vapor space of tanks, including waste tanks with flammable gas atmospheres.

Each camera system will consist of one color video camera assembly. The camera will be mounted to a deployment system designed to be installed in a 10.2 cm (4" minimum) schedule 40 riser. The deployment system shall be designed to create a very compact system for portability. A pan and tilt unit or similar type of device will add to the camera's viewing mobility in the tank. The unit would be capable of a 360° pan field of view in both wide angle and telephoto zoom modes and a tilt of 150° (+60° above horizontal), minimum. The systems will include their own lighting and safety system with all necessary controls included.

3.2 Procurement

All material procurements will be identified and accomplished in accordance with WHC-CM-2-1, Procurement Manual and Procedures. Lighting fixtures as well as key electrical components will include documentation which confirms compliance to the requirements stated in Section 2.2.5. Emergency procurements will be used only if time constraints on the item will exceed scheduled commitments.

3.3 Fabrication

Ancillary camera system components required for this installation will be designed and fabricated by Westinghouse Hanford Company (WHC)/ICF Kaiser Hanford engineers and craftsmen. The equipment associated with this task may be developed in accordance with WHC-CM-6-1, Standard Engineering Practices, EP-2.4, "Development Control." See Section 8.0 for detailed information on requirements.

3.4 Testing

Testing of the video systems will include a complete functional test of the camera system, pan and tilt unit, lighting, and the hazardous location safety systems in a mockup of a tank riser. Testing will be accomplished in accordance with an approval designator SQ approved test procedure.

3.5 Special Reviews

Required special reviews include a review by Materials and Process Engineering for material compatibility and review of the system design for hazardous locations to qualify it for use; review by Instrumentation Systems Engineering and TWRS Industrial Health and Safety for appropriate fire safety design; and a review by Independent Nuclear Safety prior to in-tank operation of the system. A design review of the camera system shall be performed prior to camera fabrication. In addition, a USQ determination will be performed in accordance with WHC-CM-1-3, Management Requirements and Procedures, MRP 5.12.

3.6 Installation

Installations will be performed on a as-needed tank basis and completed by Surveillance Systems Engineering personnel. Craft's will support the necessary installations as required. Installation will not commence until all installation work package documentation is approved in accordance with WHC-CM-8-8, Job Control System.

3.7 Maintenance/Operation

Operation and maintenance of the systems will be performed through approved Tank Farm preventive maintenance and engineering work plans.

4.0 SYSTEM FUNCTIONAL PERFORMANCE DESCRIPTION

4.1 Camera Systems

- 4.1.1 The camera systems will consist of a vendor procured color zoom lens camera and housing, deployment assembly, and lighting system. Onsite components will consist of the mobile riser platform, hazardous location safety system, and other ancillary equipment. The camera shall be designed to fit into a 10 cm (4") minimum schedule 40 pipe riser, temporarily deployed through a riser flange. The deployment device shall be capable of an insertion depth, at minimum, of 6.1 m (20'). The camera shall provide tank monitoring through the use of a pan and tilt type of system and camera zoom capabilities. The system shall be designed fail-safe for removal from the tank riser.
- 4.1.2 The lighting and camera components will be contained in an enclosed housing(s) if a purge system is implemented. The camera assembly shall have a 8,640 hour (apprx. 1 year) minimum useful

life expectancy in the tanks' radiological and atmospheric conditions based on intermittent internal tank operation or be designed with disposable components, with the spare parts on hand. The camera assemblies should anticipate a radiation field of up to 100 R/hr, hard gamma with an average expected level of 0.667 MeV (Cs 132).

- 4.1.3 The safety system design for use in flammable gas tanks for the mobile camera systems shall utilize gas measurement device(s) with an electrical interlock system or a purge system as described later in the paragraph. The gas measurement device(s) shall monitor hydrogen gas concentrations as described below, with provisions included for future ammonia monitoring. The interlock system shall be tied into an approved gas measurement control system. The system shall monitor combustible concentrations of gas (in ppm) in the tanks' atmosphere and disengage electrical power on a gas concentration rise. The gas measurement device shall be capable of responding to gas concentrations changes in less than one minute. Power to the camera, pan/tilt, gas sensor, lights and other vapor space electrical components shall be disengaged. The set point of disengagement shall be below the following maximum hydrogen concentration limits specified in table 1.

Table 1

Gas type	Concentration (ppm)
Hydrogen (H ₂)	6,250
Ammonia (NH ₃)	2,150

If a NFPA type Z purge system is employed, the purge supply lines shall be fabricated of durable tubing and fittings. The purge system shall include a nitrogen bottle supply system (or compressed dry air) and a purge panel similar in concept to the design of the existing camera system units with the exception that safety interlocks are not required. An alarm, visual or audible, or an indicator for system pressure or flow loss is required. The compressed gas will purge the mast, pan and tilt (if included) and feedback sensors, camera and housing, lights, and other vapor space components. Designs other than the gas purge system shall be reviewed and documented for verification of conformance to the specified requirements.

- 4.1.4 The pan and tilt type of maneuvering system shall have a 360° effective field of view in both telephoto and wide angle modes, and the tilt actuator shall have a range of 150° minimum (- 90° from horizontal, + 60° minimum from horizontal) for near full coverage of the tank interior. Flexible hoses will dictate flexibility of the tilt system.

- 4.1.5 A control system for the pan/tilt unit shall be provided. The controller and monitoring systems shall be integrated with the mobile base unit.
- 4.1.6 The mast shall meet tank farm seismic requirements currently imposed on temporary structures and shall be analyzed, if necessary, prior to commencement of any design or fabrication effort.
- 4.1.7 The zoom camera shall have roughly a 8:1 zoom capability for tank component viewing. The camera shall be capable of limited viewing distance, 9.1 m (30'), with adequate support lighting in all camera viewing situations.
- 4.1.8 Lighting fixtures shall be UL listed. If a purge type system is employed, the maximum surface temperature of the enclosures shall not exceed 80% of the autoignition temperature of the gases, approximately 395°C (742°F).
- 4.1.9 All materials used in the camera design which are located in the vapor space shall be compatible with the radiological and chemical constituents.

4.2 Design Verification

Verification of the design of the video systems will be documented accordingly per WHC-CM-6-1, Section 4.1. Verification approval will be for Approval Designator SQ. Reviews may take place in parallel with the fabrication and assembly. Installation and use of the system will not be allowed until final design verification has been completed and all required approvals have been obtained.

All electrical components for this system shall conform to the National Electric Code (NEC) requirements.

Approval for installation and operation of any electrical component in the vapor space will be upon design verification in accordance with WHC-CM-6-1, Section 4.1.

5.0 ORGANIZATIONAL RESPONSIBILITIES

Listed below are tasks assigned to each organization involved in the project. The items listed are the major activities for each group and may not include all areas of responsibilities that may be implied by the specific task. All appropriate training by engineering staff shall be obtained and/or maintained to satisfactorily perform onsite tasks in the tank farms.

5.1 Customer

Customer: GD Johnson (Flammable Gas Tank Safety)

The Customer for this project is Jerry Johnson in the Flammable Gas Tank Safety Program. The Customer will have overall input on the requirements and direction for the camera systems. The Customer will provide funding and scheduling requirements for the activities.

5.2 Responsible Manager and Engineer

Responsible Manager: TL Moore (Safety Equipment Development)
Responsible Engineer: EH Kohlman (Safety Equipment Development)

The Responsible Manager has overall responsibility in implementing the design and fabrication of the camera systems. All other organizations will be responsible to the Responsible Manager and Engineer. The following are the major tasks of the Responsible Manager and Engineer.

- 5.2.1 Provide project management, coordination, and direction on the camera systems and related components.
- 5.2.2 Overall project scheduling and budget development.
- 5.2.3 Overall design review of the camera systems, nitrogen purge or other qualified hazardous location safety system, and ancillary equipment.
- 5.2.4 Prepare ETP.
- 5.2.5 Support and provide input to the environmental and safety assessment individuals with their tasks.
- 5.2.6 Perform lead role during formal design review of the camera system.
- 5.2.7 Assist in system acceptance test plans (ATPs), operational test plans (OTPs), and system turnover acceptance for beneficial use (ABU).
- 5.2.8 Provide mechanical support on the program.

5.3 Camera System Design Manager and Engineer

Camera System Design Manager: DB Smet (Surveillance Systems Engineering) Mobile Camera System Engineers: RH Webb / RS Robinson (Surveillance Systems Engineering)
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The Camera System Design Manager and Engineer(s) will be accountable to the Responsible Manager and Engineer and will primarily interface with the Responsible Engineer. As the title implies, the Camera System Design Manager and Engineer will be responsible for all activities associated with the camera system. Interfacing with related systems is also the responsibility of this organization. The following are the major responsibilities of this task group and may not be all inclusive.

- 5.3.1 Design of the camera system, design and fabrication support of the mobile base unit, design and development of the camera deployment system, and assist in the development of the hazardous location safety system. Also responsible for placement of control and monitoring equipment on the mobile base.
- 5.3.2 Provide input and interface with related systems or activities such as the gas sensing system or nitrogen purge system, electrical, environmental/safety assessments, structural/seismic analysis (if required), etc.
- 5.3.3 Provide input to the ETP.
- 5.3.4 Provide input to environmental and safety assessment organizations, gas sensing system, nitrogen purge activities, electrical, Quality Assurance (QA) organization, future tank farm installation activities, seismic/structural reviews, and others as necessary.
- 5.3.5 Provide support during design reviews on the camera systems. Provide input and resolutions to comment reviews.
- 5.3.6 Provide procurement documentation, including any sole source justifications required for expedited procurement. Perform all review and comment resolutions.
- 5.3.7 Vendor interface for the camera unit. Witness functional testing at the vendor facility, if possible.
- 5.3.8 Provide the performance, guidance and direction during camera installations. Provide work package direction and assistance as required to ensure proper installation is attained.
- 5.3.9 Provide lead coordination and direction during testing and use of camera systems and ancillary equipment. Provide and lead ATP/OTP documentation.

- 5.3.10 Provide functional design criteria on the camera system to both the ETP and to the procurement specification.
- 5.3.11 Provide required documentation as identified in the ABU checklist.
- 5.3.12 Act as the cognizant engineer, the design authority, and customer for Plant Engineering for all structures, systems, and equipment provided by this project.
- 5.3.13 Assist in the determination of what is required for ABU.
- 5.3.14 Accept primary engineering responsibility for the camera system provided by this project after approval of ABU. Assume ownership of the camera system.

5.4 Nitrogen Purge Safety System Engineer (Optional)

Nitrogen Purge Safety System Engineer: EJ Walter (System Structural Integrity Assessments)

If a purge system is implemented, the Nitrogen Purge Safety System Engineer will be accountable to the Responsible Engineer for all activities and tasks performed and will work with the Camera System Design Engineer in the design and development of the purge system. The following are the major responsibilities of the engineer and may not be all inclusive.

- 5.4.1 Provide either a complete nitrogen purge system for the mobile camera(s) or the design and development of a system qualified for use in the hazardous location as specified in the requirements section. The purge system will encompass a new purge panel and control system for the new camera systems.
- 5.4.2 Responsible for interfacing with associated activities and organizations.
- 5.4.3 Provide comment resolution, input, and support during design reviews on the nitrogen system.
- 5.4.4 Provide guidance and direction on design and installations as required. Develop Engineering Change Notices (ECNs) as needed.
- 5.4.5 Coordinate testing and final turnover of the system.

5.5 Electrical Support Engineer

Electrical Support Engineer: JE Dunks (Electrical Power Systems)

The Electrical Support Engineer will provide electrical support on the camera system and will be accountable to the Responsible Engineer. The

Electrical Support Engineer will provide all electrical support on the task including design for the nitrogen purge system, if used.

- 5.5.1 Provide electrical design support on the program. This includes power systems to the camera lights, pan/tilt (if installed), camera control panels, gas sensing system or the nitrogen purge system.
- 5.5.2 Responsible for interfacing with associated activities and organizations.
- 5.5.3 Provide comment resolution, input, and support during design reviews on the electrical systems.
- 5.5.4 Provide guidance and direction on design and installations as required. Develop ECNs as needed.
- 5.5.5 Coordinate testing and final turnover of electrical systems.

5.6 Assessments

Environmental Documentation Review: WR Brown (Regulatory Support) Environmental Assessment: SR Tiff (NEPA Documentation Organization) Safety Assessment: RJ Van Vleet (Double-Shell Tank Safety Assessment)

The support organizations will provide assessments, environmental and safety, on this program. The assessments may be part of the ongoing overall assessments or be individual assessments covering these specific areas.

- 5.6.1 Provide appropriate environmental documentation. This includes preparing a documented plan, conducting an independent assessment of operational readiness with respect to environmental protection, and verifying that all required environmental documentation is in place relative to this task in accordance with WHC-CM-1-5, Standard Operating Practices Manual, Section 1.2, "Operational Readiness Reviews." Currently this task is covered under an ongoing generic environmental assessment for these double-shell tanks.
- 5.6.2 Ensure appropriate National Environmental Protection Act (NEPA) reviews and documentation are prepared as required.
- 5.6.3 Provide safety assessment documentation. This includes preparing a documented plan and providing input for a safety review (USQ screening) on operational readiness in accordance with WHC-CM-1-5, Section 1.2, "Operational Readiness Reviews."

5.7 Structural/Seismic Support Engineer

Structural/Seismic Support Engineer: JP Strehlow (TWRS Engineering Support)

The Structural/Seismic Support Engineer will provide engineering support on the camera system and will be accountable to the Responsible Engineer. The Structural/Seismic Support Engineer will provide all analysis support on the task including interfacing with offsite analysis contractors.

- 5.7.1 Provide structural and seismic analysis support on the program. This includes analysis of the camera assembly, mobile base, and other requested analysis needs.
- 5.7.2 Responsible for interfacing with associated activities and organizations.
- 5.7.3 Provide comment resolution, input, and support during design reviews on structures.
- 5.7.4 Provide complete analysis reports and preliminary reports to engineering when required.

5.8 TWRS Operations Support

TWRS Operations: TBD (TWRS Operations)

TWRS Operations will provide operations input on the camera system for compliance with tank farm requirements.

- 5.8.1 Provide input and reviews on the camera system designs to determine site adequacy and physical interface issues with the design.

5.9 TWRS Nuclear Safety / TWRS Industrial Health and Safety

**Nuclear Safety Review: Steve Krogsrud (TWRS Nuclear Safety)
Fire Protection Review: Rick Huckfeldt (TWRS Industrial Health and Safety)**

These support organization will provide review and input in the areas of Nuclear safety and health and fire protection safety on the program.

- 5.9.1 Provide appropriate reviews and support of documentation, procurements, and test plans/procedures assigned with the approval designator "S".
- 5.9.2 Provide input in the design of the systems and components.

5.10 ABU Requirements

This section will describe the acceptance for use requirements on this program prior to final acceptance of the camera system. The following table from the ABU document is included to identify tasks to be completed, responsible individuals, and scheduled completion dates for these tasks.

DOCUMENTATION REQUIRED FOR ACCEPTANCE FOR BENEFICIAL USE			
DESCRIPTION	RESPONSIBILITY	DESCRIPTION	RESPONSIBILITY
<u>ENGINEERING</u>	INDIVIDUAL	<u>ENGINEERING cont'd</u>	INDIVIDUAL
• Engineering Task Plan (ETP) [X]	Kohlman	• Incorporate outstanding project generated ECNs []	
• Activity Schedule []		• Software Configuration Management Plan []	
• Final Safety Analysis Report (FSAR) []		• System Requirements Specs. []	
• Interim Safety Basis - update []		• Software Design Description []	
• Safety Assessment (SA) [X]	Van Vleet	• Validation & Verification Records []	
• Safety Equipment List (SEL) [X]	Fein	• System Qualification Plan [X]	Smet
• Operational Safety Requirements (OSR) - or update existing []		• Personnel Qualification Record [X]	Smet
• Operational Safety Document(s) (OSD) - or update existing []			
• Functional Design Criteria (FDC) [X]	Kohlman	<u>TRAINING</u>	
• Conceptual Design Report (CDR) []		• Training Plan []	
• Supplemental Design Requirements Document (SDRD) []		• Training Manuals []	
• System Design Description (SDD) [X]	Smet/Kohlman	• Training to Operating Crews []	
• Test Plan/Specifications []		• Training to Maintenance Crews []	
• Acceptance Test Procedures (ATPs) and Final Test Report [X]	Smet	• Training Mock-Up []	
• Operational Test Procedures (OTPs) and Final Test Report [X]	Smet	<u>OPERATIONS/ MAINTENANCE</u>	
• Environmental Impact Statement []		• Operating and Maintenance Manuals []	
• Environmental Report []		• Operating Procedures []	
• Environmental Permit []		• Surveillance Procedures []	
• Hazardous Waste Disposal Plan/Procedures []		• Calibration Procedures [X]	Smet
• Solid Waste Disposal Plan/Procedures []		• Preventative Maintenance Procedures [X]	Smet
• Stress/Seismic Analysis [X]	Strehlow	• Repair/Maintenance Procedures [X]	Smet
• Stress/Design Report [X]	Strehlow	• Functional Check Procedures []	
• Design Specifications/Report []		• CBRS (PM/S) Data Sheets []	
• Equipment Specifications []		<u>QUALITY ASSURANCE</u>	
• Procurement Specifications [X]	Smet	• Inspection Plan []	
• Construction Specifications []		• QAPP []	
• Essential Material Specifications []		• QAP _J P []	
• Final Design Drawing(s) [X]	Smet	<u>PROCUREMENT ACTIVITIES</u>	
• Installation Drawing(s) []		• Vendor Information Files [X]	Smet
• Installation Work Plan []		• Comprehensive Equip. List []	
• As-built Drawing(s) [X]	Smet	• Spare Parts List [X]	Smet
• Interface Control Drawing(s) []		• Spare Parts in Stock []	
• IEFD Drawing(s) []			
• Systems Drawing(s) []			
• Drawing Tree [X]	Kohlman		

6.0 SCHEDULE

All hardware for the two mobile camera systems will be ready for testing by September 20, 1995. See separate schedule for details.

7.0 COST ESTIMATE

Task	Responsible Organization	Funding Req'ts (K)
1. Materials	Camera System Design Organization	\$121.1
2. Project Lead	Responsible Manager and Engineer	\$49.2
3. Camera System Design	Camera System Design Organization	\$95.9
4. Design/Drafting	Design Services	\$27.2
5. Nitrogen Purge System	Nitrogen Purge System Engineer	\$48.9
6. Electrical Design Support	Electrical Support Engineer	\$33.6
7. Safety/Environmental Assessments	Safety and Environmental Organizations	\$31.0
8. Industrial/Nuclear Safety Support	Industrial/Nuclear Safety	\$7.8
9. Quality Assurance	Quality Assurance	\$6.1
10. OPS, HPT, Maintenance, Crane and Rigging Support	OPS, HPT, Maintenance, Crane and Rigging Organizations	\$0.0
11. Analysis	Structural and Materials Organizations	\$6.0
12. Purge Panels Fabrication	Fabrication Shops	\$38.8
13. Purge Panel Materials	Shops	\$44.0
TOTAL		\$509.6

* Cost may not be incurred since purge is optional
HPT = Health Physics Technician
OPS = Operations

8.0 QUALITY ASSURANCE

QA requirements for activities defined within the scope of work shall be in accordance with the U.S. Department of Energy, Richland Operations Office Order 5700.1A, and WMC-CM-4-2, Quality Assurance Manual. These documents establish American Society of Mechanical Engineers, Quality Assurance Program Requirements for Nuclear Facilities as the quality standard for this work. The intent is to provide assurance that the facility and equipment are adequate to meet task requirements; the prepared plans and specifications adequately state QA requirements; fabrication and construction are performed in accordance with the design; and tests confirm the adequacy of design and the quality of construction and manufactured components, where appropriate.

Vendor testing of the camera assemblies shall be performed at the vendor's facility prior to shipment and shall be witnessed by the Camera System Design Engineer and an individual from QA. ATP/OTP testing of the camera assemblies including all hazardous location safety systems shall be performed onsite after installation has been completed. Components of the purge panels or other hazardous location safety devices shall be calibrated and tested prior to being shipped to the field. Documentation shall be provided for compliance with NEC and NFPA requirements.

The equipment associated with this project may be developed in accordance with WHC-CM-6-1, EP-2.4, "Development Control." The fabrication will be completed using "Development Control" design sketches followed by releasing approved as-built H-2- drawings. Changes to the "Development Control" design sketches will be controlled by either marking the changes in "red" or preparing additional sketches and identifying traceability with the affected sketch. All changes will be approved by the Responsible Engineer by signing and dating the changes. A log book should be kept to trace the drawing changes and to log the justification for each change. The drawings will also be verified through field inspection to ensure that they accurately reflect the fabricated items. The drawings will be released prior to using the equipment in the single-shell tank farms. All inspection and testing requirements will be identified on the drawings and/or documentation used on this program. All inspections and tests will be documented and recorded per approved procedures.

9.0 APPROVAL DESIGNATOR

An approval designator of SQ applies to the overall work scope of the camera system designs and flammable gas tank installations. Drawings related to the purge system and grounding requirements will be SQ. All other drawings may be Q or NA.

10.0 SAFETY CLASS

The overall safety class of this program is Safety Class 1. The following are the sub-assemblies with their respective safety classification for this task.

- 10.1 The lighting and electrical conduit and connectors which are located in the tank vapor space (tank atmosphere) will be Safety Class 3.
- 10.2 The balance of the camera, pan and tilt, support structure, and housings will also be Safety Class 3.
- 10.3 Fittings, hoses, wiring, raw materials, etc., will be Safety Class 4. Fasteners shall be Safety Class 3.
- 10.4 The control systems for the purge system or the gas measurement system and safety shut-off controls will be Safety Class 1.

- 10.5 Components which do not control purge operation or hazardous location safety systems may be Safety Class 4.