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APPROVED FOR PUBLIC RELEASE

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ENGINEERING DATA TRANSMITTAL

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1		Safety J.W. OSBORNE	[signature]	6/21/95	X3-80						
1		(Env.) K-Basins Standards & Requirements Mgr. C. DEFIGH-PRICE	[signature]	6 21-95	X3-79						
1		K-Basins Engineering Mgr. J.P. SCHMIDT	[signature]	6/21/95	X3-78						
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7. Abstract

K-Basin (Facility), SNF (Project), and other engineers performing work at the 100-K Area need to utilize a common document to communicate, plan, organize, and execute activities to accomplish goals efficiently. The document provides guidelines for; the design of equipment for fuel basin use, facility modifications (upgrades), remote tools, and new processes. The guidelines define; facility systems, work processes, approval processes, and describes the requirements associated with particular activities.

8. RELEASE STAMP

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K Basin Design Guidelines

K Basins Standards and Requirements
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AA	A type (size) of surface finish
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BHI	Bechtel Hanford, Inc.
CADD	Computer-aided Design and Drafting
CCA	Criticality and Consequence Analysis
CFR	Code of Federal Regulations
CSR	Criticality Safety Representative
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Field Office
ECO	Environmental Compliance Officer
HEPA	High-efficiency particulate air (filter)
HSRCM	Hanford Site Radiological Control Manual
IEEE	Institute of Electrical and Electronics Engineers
IFC-KH	IFC Kaiser Hanford Company
IXM	Ion Exchange Module
IXC	Ion Exchange Column
JCS	Job Control System
KE & KW	K East & K West (General referring to the basin buildings)
MCO	Multiple Canister Overpacks
MK	Mark (Type of fuel storage container)
MSDS	Material Safety Data Sheet
NDT	Nondestructive Testing
NFPA	National Fire Protection Association
PFWR	Plant Forces Work Review
P&ID	Piping and Instruction Design
PM	Preventative Maintenance
SAR	Safety Analysis Report
SNF	Spent Nuclear Fuel
S/RID	Standards/Requirements Identification Document
SSP	Site Specific Plan
VAC	Volts alternating current
VDC	Volts direct current
WHC	Westinghouse Hanford Company

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1.0 GENERAL

The purpose of the design guidelines is to enable SNF and K Basin personnel to complete fuel and sludge removal, and basin water mitigation by providing engineering guidance for equipment design for the fuel basin, facility modifications (upgrades), remote tools, and new processes. It is not intended to be a purchase order reference for vendors. The document identifies materials, methods, and components that work at K Basins; it also provides design input and a technical review process to facilitate project interfaces with operations in K Basins.

This document is intended to compliment other engineering documentation used at K Basins and throughout the Spent Nuclear Fuel Project. Significant provisions, which are incorporated, include portions of the following: General Design Criteria (DOE 1989), Standard Engineering Practices (WHC-CM-6-1), Engineering Practices Guidelines (WHC 1994b), Hanford Plant Standards (DOE-RL 1989), Safety Analysis Manual (WHC-CM-4-46), and Radiological Design Guide (WHC 1994f). Documents (requirements) essential to the engineering design projects at K Basins are referenced in the guidelines.

1.1 POLICY

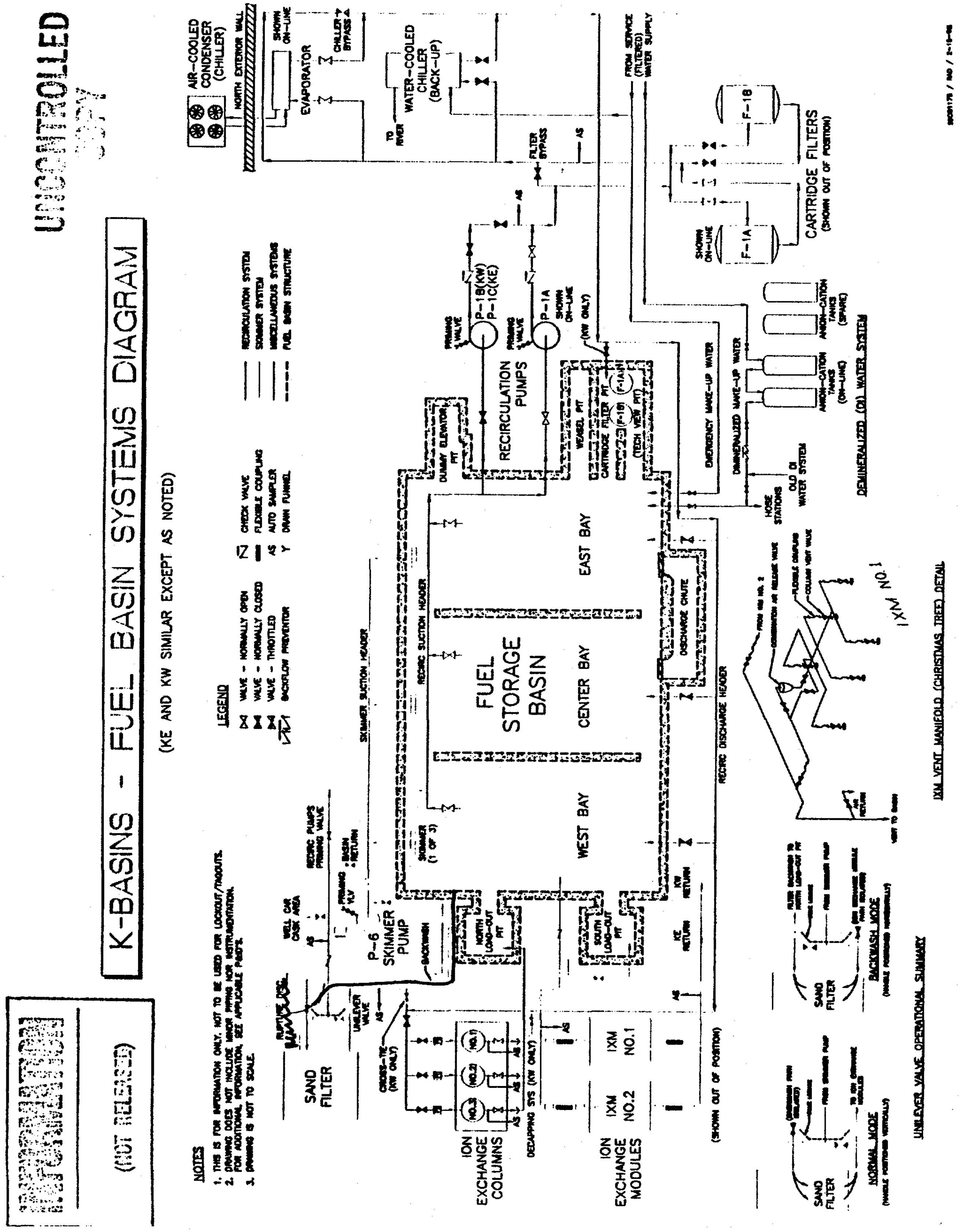
K Basins Policy Manual (WHC-CM-5-13) establishes policies for the K Basins organization, which are based on, and/or comply with the policies, goals, laws, rules, and requirements applicable of the Westinghouse Hanford Company (Westinghouse Hanford).

1.2 GENERAL DESIGN GUIDELINES

The 100 K Area consists of two irradiated fuel storage basins (105 KE and 105 KW) and related support facilities. The two K Area irradiated fuel storage basins, built in the early 1950s, were designed for the temporary storage of irradiated single-pass reactor fuel from the attached 105 KE and 105 KW reactors prior to shipping it to the PUREX facility for processing. The KE and KW single-pass production reactors stopped operating in 1971 and 1970, respectively.

The 105 KE basin has been used for interim storage of N Reactor irradiated fuel assemblies since June 1975, and the 105 KW basin has been used for these assemblies since February 1981. The basins are divided into three bays with other adjoining sections (see Figure 1-1). The basins, which are 20 feet (ft) deep, have 16 ft of water covering the fuel. Load out zones, which are 26 ft deep, have a water depth of 26 ft (see Figure 1-2 and refer to drawing H-1-45071 [WHC 1984]). The area behind the load out pits (where ion exchange modules are located) is shown in Figure 1-3, and the area above the water is shown in Figure 1-4.

Figure 1-1. K Basins Fuel Basin Systems Diagram.



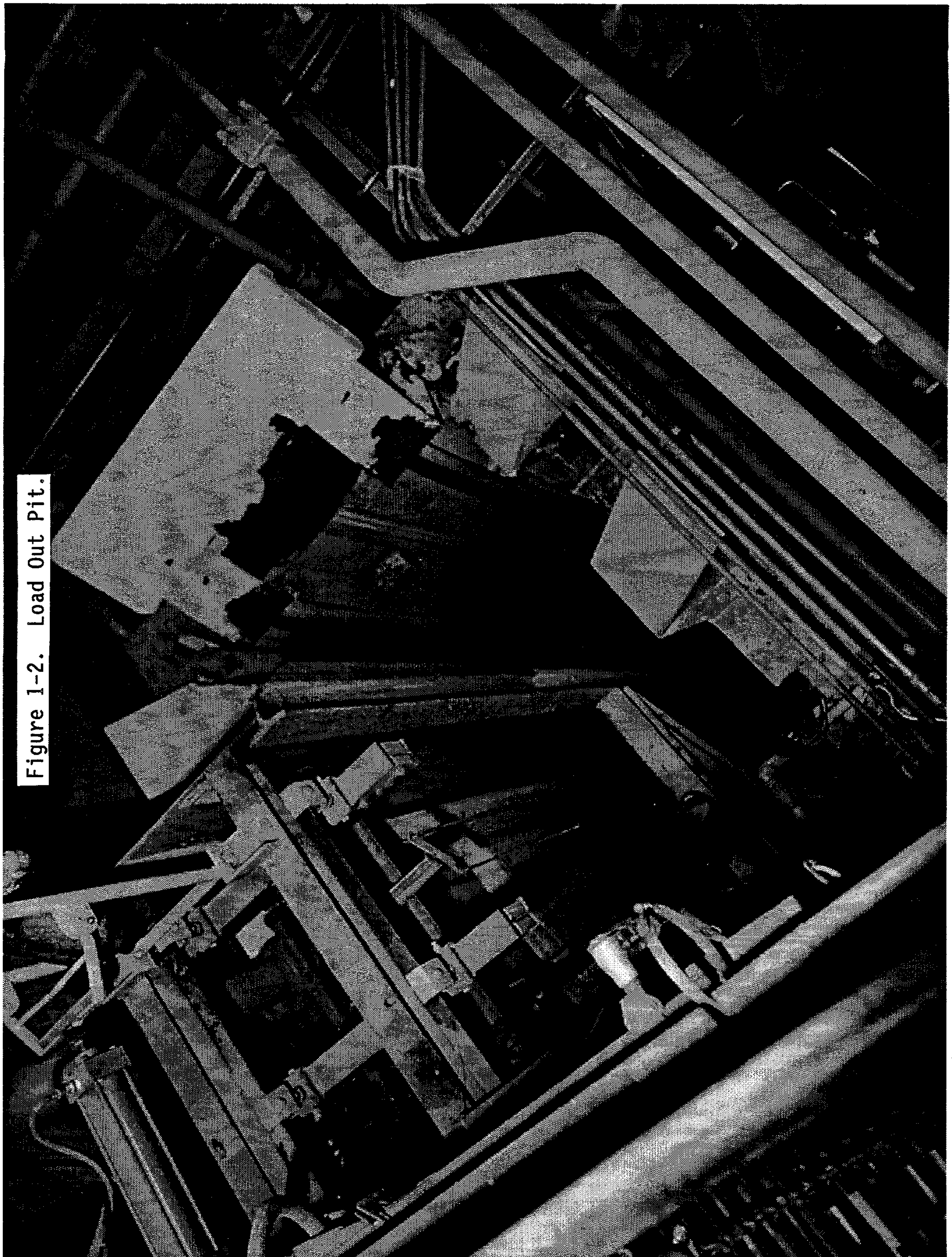


Figure 1-2. Load Out Pit.

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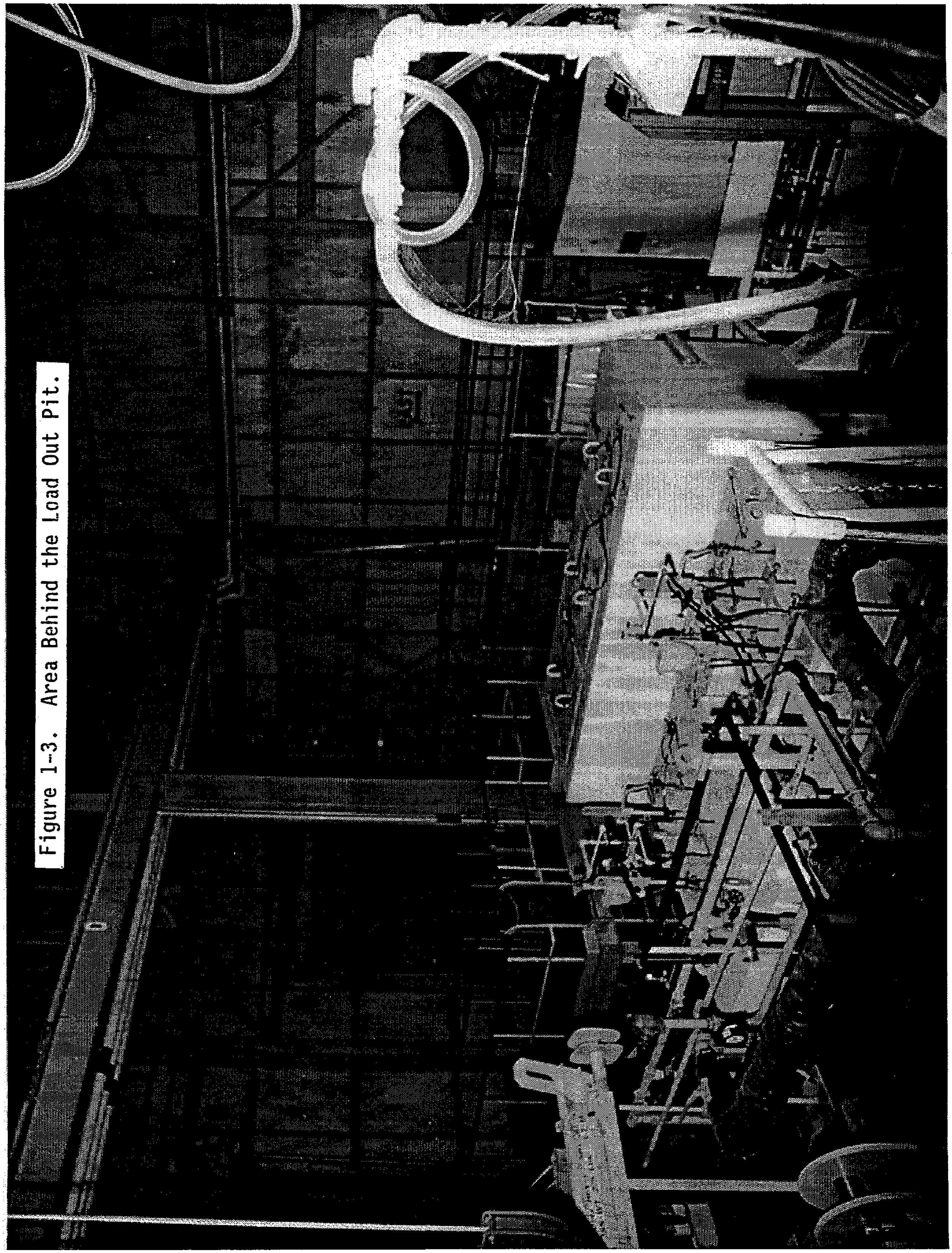

Figure 1-3. Area Behind the Load Out Pit.

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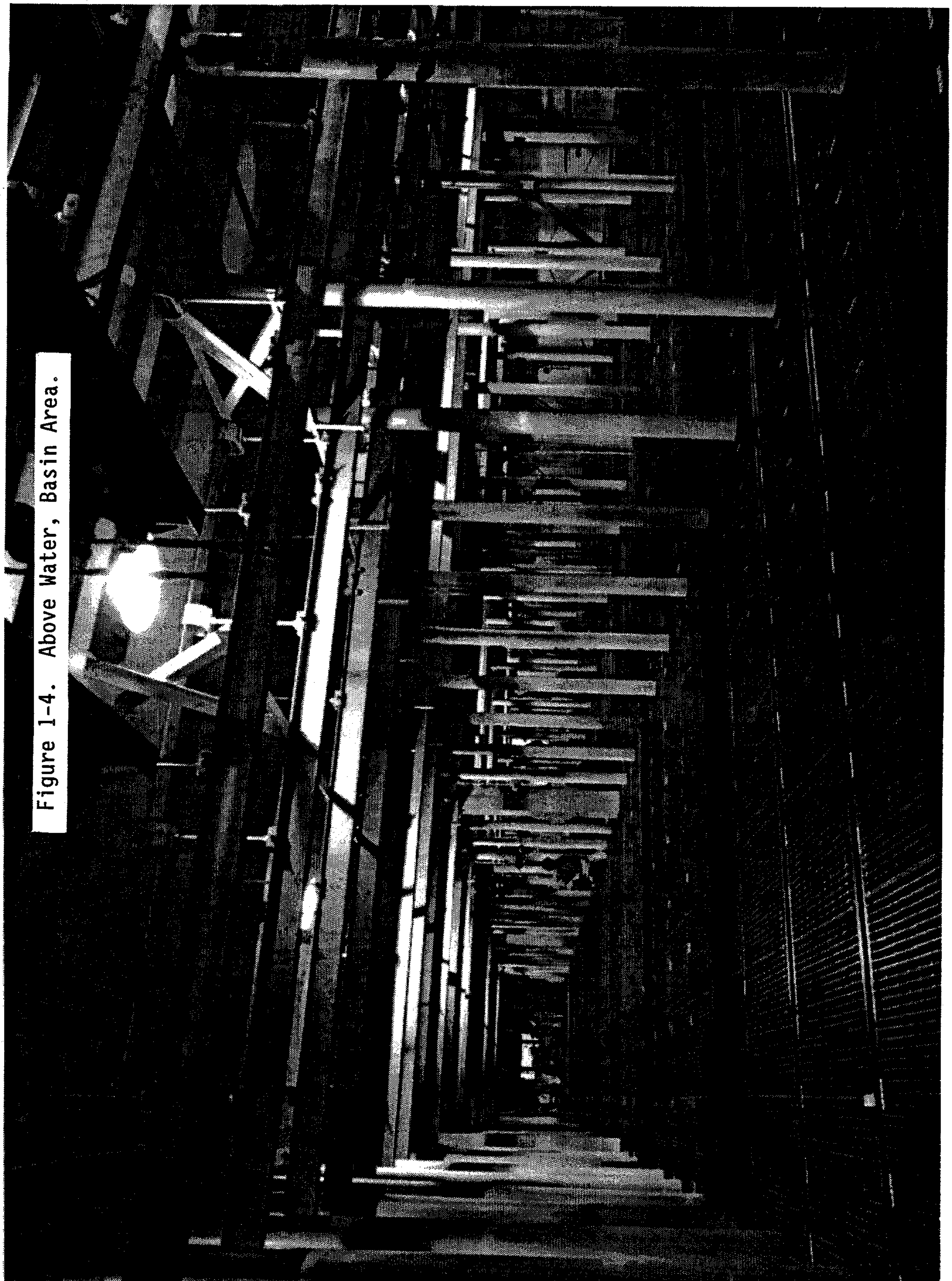

Figure 1-4. Above Water, Basin Area.

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The Hanford Purex Plant stopped operating before processing a back-log of irradiated N Reactor fuel. Approximately 2,100 MTU of irradiated N Reactor fuel are still stored in the two basins in relatively evenly divided quantities. A small quantity of unprocessed Hanford single-pass reactor fuel is also stored in each basin.

The fuel storage basins isolate, shield, and cool the irradiated fuel until it can be transferred to another facility.

Equipment intended for use at K Basins must be compatible with space limitations and facility allocations inside and outside the fuel basin. The equipment must be designed to be installed and removed by the available lifting and transfer systems unless special backfit and upgrade provisions are provided for. All systems outside the fuel storage basins are discussed in Section 5.0.

Equipment, facilities, and processes shall operate at greater than 70 percent reliability to support fuel shipments from the basins starting December, 1997 (unless the Safety Analysis Report or Operational Safety Requirements state differently). Supporting systems generally must operate at greater than 70 percent to achieve 70 percent overall. Scheduled equipment outages are to be designed so as to not affect total system availability. All equipment must be designed to emphasize the following: environmental compliance, safety, quality, reliability, ease of remote operability, maintainability, and ease of decontamination. Environmental compliance is primary as there are environmental documentation requirements associated with most new materials entering the basins or new processes occurring inside or outside the basins. In addition, emphasis must be placed on ease of maintenance and the capability to remotely disassemble the equipment for repair and eventual final disposal (see Section 2.7.3).

All design phases require significant reviews of equipment, (facility modifications and/or process changes), equipment requirements, and the design basis. Peer, operational, and supervisory review is applicable to conceptual, preliminary, final, and manufacturing release stages of approval. Equipment design, use, operation, and disposal shall be based on the lifetime of project not long term in place operation.

1.3 DESIGN SEQUENCE

The design sequence is described in detail in the K Basins Plant Review Guidelines (WHC 1995d). Reviews (see Attachment 1) are required to ensure that the design of equipment and tooling complies with requirements of reliability, operability, maintainability, environmental, safety, and quality. Specific reviews may be deleted or abbreviated by management if the simplicity of the design warrants as determined by the K Basin Technical Review Team. Development control requirements must be according to Standard Engineering Practices (WHC-CM-6-1), Section 2.4, and documentation according to Engineering Practice Guidelines (WHC 1994b).

1.3.1 Project Management Plan

Define a Project Management Plan that identifies, as early and as detailed as possible, goals and objectives of the project, equipment, facilities, and the processes involved.

1.3.2 Process Environmental, Safety, and Quality Analysis

Reviews of environmental and codified nuclear safety regulations and DOE directives must be conducted to protect against noncompliance that could lead to monetary fines or other damages. A review of nuclear safety features must also be conducted to protect against nuclear accidents such as those listed in Attachment 3. Engineering document reviews shall be performed in accordance with Westinghouse Hanford and facility requirements to ensure applicable criteria are specified and consistent with regulatory requirements. Ideally, the process Environmental, Safety and Quality review and identification of applicable requirements would be completed before the designer begins to design. In practice, the process Environmental, Safety, and Quality analysis and equipment/process conceptual design usually are completed concurrently.

1.3.3 Preliminary Equipment/Modification/Process Change Design

The preliminary design review, initiated by the designer and cognizant manager, presents to peers all topics which shall be considered in satisfying the goals and objectives of the project. This presentation shall involve knowledgeable support groups such as radiological control, ALARA control, quality assurance, operations, etc. Comments resulting from the review shall be documented and reconciled. Some persons, who participated in the final review, shall be maintained for future reviews to ensure familiarity and comment resolutions.

A review of layouts for the equipment/activity and its application must result in comments that will provide detailed information for drafting request instructions.

1.3.4 K Basins Plant Project Review

An independent chairperson and a committee are selected by K Basins Standards and Requirements to lead the review. The committee is composed of persons from various organizations who have a direct interest in the project or who have applicable experience such as radiological controls and lifting and handling operations. The committee may also include outsiders to provide a broader based review.

A meeting is held to distribute design material and provide a brief design description. The chairperson may assign specific areas to be reviewed or ask for general comments. Members are to provide written comments to the chairperson before the next meeting. Comments and resolutions shall be documented. The chairperson shall organize all comments, and designers shall resolve them before the next meeting. Comments that cannot be resolved in the meeting will be resolved by the designer with the comment originator. The chairperson will decide if additional meetings are necessary and will issue a design review report to the cognizant manager. The report shall include a brief description of the design, committee comments, and comment resolution. The chairperson will state whether the committee agrees that the design meets all applicable requirements.

1.3.5 Spent Nuclear Fuel Design Review Committee

This is a formal review by the Design Review Committee. Most design reviews need to be conducted at preliminary and final design stages in accordance with Engineering Practices Guidelines (WHC 1994b) EPG-4.1, Standard Engineering Practices (WHC-CM-6-1), EP-4.2, and K-Basins Plant Review Guidelines (WHC 1995d). ALARA reviews must be included. ALARA reviews are required by the Hanford Site Radiological Control Manual (WHC 1994c), Art. 311 and "Occupational Radiation Protection" (10 CFR 835). The design review requires a well documented design review package (see Attachment 4). The documentation shall include the documents of previous reviews and clearly show the reconciliation of comments from previous reviews. This review shall be documented on the Equipment Completion Checklist (see Attachment 2) which highlights major items of documentation listed in Attachment 4. This review shall be performed before committing a new system or piece of equipment to a radiologically contaminated environment. This review documentation is considered to represent the independent review required by WHC-CM-4-2, Quality Requirement 3.

Any transfer of a design between groups or between designers in a group shall be performed with detail similar to a design review. This will ensure that the ideas, design aims, and controls envisioned by the designer support the requirements.

1.3.6 Cognizant Engineer Approval

Engineering documentation shall also be approved by K Basin cognizant engineers for the affected basin systems (e.g., Functions and Requirements, drawings, engineering change notices, and acceptance test procedures).

1.3.7 Manufacturing Release

A design review, using detailed drawings of equipment or tools, shall be performed before approving a design for fabrication. This review is applicable to Westinghouse Hanford and outside source designers. The review shall have the scope required of the K Basins and Spent Nuclear Fuel project reviews previously described. The review shall also include an environmental, nuclear safety, and quality evaluation; and it shall demonstrate how the equipment/upgrade/modification process meets the prescribed applicable requirements described in Section 1.3.2.

1.3.8 Computer Program Control

1. The registration, verification, and documentation of design-type computer programs is specified in Software Practices (WHC-CM-3-10).

2. Programs used to operate K Basins equipment shall be, after qualification, protected by filing a copy according to WHC-CM-3-10.

3. Software to support the Spent Nuclear Fuel Path Forward mission shall be validated and developed according to WHC-CM-3-10 and Quality Assurance Manual (WHC-CM-4-2).

1.3.9 Design Drawings - Requirements and Controls

Drawings are required at every stage of the design review sequence. Because layouts, assemblies, clearance and arrangement studies, and detail drawings become part of the design review documentation, standards have been established for drawing content and control.

- Drawings created at K Basins to support design of new equipment or the modification of existing equipment are made to WHC-CM-6-1, EP 1.3.

- Interface control drawings created for activities at K Basins must be developed to show a holistic picture of the components involved. For example, interface control drawings shall be developed to show the following:

  - Envelope dimensions of K Basins.

  - Envelope dimensions of crane heights and crane movements in every direction in which the crane will be moved.

  - Envelope dimensions for the basin floor area on which multiple canister overpacks (MCO) and fuel handling equipment will rest and clearances between the wall and the MCOs.

  - Clearance required for lifting the fuel canisters and drilling holes to remove water and for placing the canisters in the MCO.

  - Height required for lifting MCOs for decontamination before being placed on a truck.
  - Clearance required for removing the MCOs from the building to a truck.

  - Dimensions for how close the truck can be to the basin building.
  - Load capacity of the basin floor
  - Tool dimensions that interface with existing basin equipment.

- Drawings, which are provided by outside suppliers, must provide basic information for the fabrication, repair, maintenance, or modification of equipment. The basic requirements for supplier-furnished drawings are listed in Attachment 9.

- Boeing Services is responsible for tracking documents when drawings are released (Release\Archive Notification) and for completing the approval process. The Data Management System will track subsequent status and changes.

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2.0 SPECIAL INSTRUCTIONS FOR INSIDE AND OUTSIDE THE BASINS

2.1 LIFETIME OF THE FACILITY AND EQUIPMENT

Facility modifications and fuel handling equipment shall be designed to have an operational lifetime of at least two times the anticipated need period or number of cycles. Therefore, although the need period is 10 years, most facility structures or fuel handling equipment should be designed or maintained for at least 20 years.

The structural integrity of roofs and other structural components will be maintained for a five-year period after being turned over for decontamination and decommissioning.

2.2 OPERATIONAL FEATURES

Careful consideration must be given to the operation of all equipment features. All required operations (inside and outside the basins) must be compatible with the force and dexterity of the tools used and with ALARA considerations. Particular attention must be paid to minimizing operational radiation exposure and contamination. It is also essential to maintain an access path with adequate clearance so that all lifting is safely and successfully done. The communications, which are necessary to operate and maintain equipment and systems concurrently with other activities, shall be considered. This may require the installation of special communications equipment. Camera mounts must be designed to dampen potential vibration from concurrent activities for closed circuit television applications.

Specific in-basin activities require a more comprehensive description. All operations with water basin equipment must be done directly overhead with probe poles. Probe pole operations shall be up or down and/or rotational but not lateral. When lifting is required, there must be an access path with adequate clearance to allow remote grappling with existing monorails or an overhead crane hook.

2.3 PERIODIC MAINTENANCE

Materials must be selected which will ensure trouble-free equipment operation. Materials used inside the basins must be able to operate in basin water that is
1) deionized/demineralized and 2) between 40 and 85 °F. Materials used outside the basins must be able to operate in temperatures between 20 and 110 °F. To ensure reliability, the design engineer shall use basic reliability-centered maintenance principles in the initial design process, that is, various sources will be used to determine the equipment/components that are most reliable for the intended environment. Equipment components, which may fail or wear out before the end of the projected life cycle, shall be identified and appropriate spares provided to assure that the equipment can be maintained operational (see Attachment 4, Section 8.5). Understanding failure modes and the mean time between failure of components

being considered for the design is vital to meeting the functional requirement of trouble-free operation. Periodic maintenance capabilities shall be designed into systems to prolong their effective lifetime at a minimum cost and downtime. If the actual reliability of the components/equipment is known, then realistic preventative maintenance can be specified in the initial design. This is important for minimizing the exposure of personnel and maximizing the life of the equipment.

Modular motorgear drive systems may be lubricated, sealed, and/or internally pressurized to reduce wear and improve reliability. Materials used outside the basins must be resistant to functional damage that may occur from radiological sources. Materials used inside the basins must be resistant to functional damage from 10^4R/hr (10^8R total accumulated dose [10^{10} grays*]) beta and gamma radiation levels or be easily replaceable. Inside the basin, delicate electronics requiring outside repair must be designed to protect against damage from an inadvertent drop during handling in the fuel storage basins. This design must consist of integral handling rings or a shock absorbing structure. Material used for fuel storage racking shall meet the specifications outlined in the "Safety Analysis Report for N Reactor Irradiated Fuel" (WHC 1994g). Existing storage racks shall be used whenever possible and/or feasible. For example, existing fuel racks will be used for staging before an MCO loading.

Electronic equipment, which will be subjected to contaminating environments (in or out of the basins), shall be in sealed units that are readily decontaminated for shop repair or be expendable. The design engineer needs to consider devices that are self-calibrating or "smart". This will contribute to minimizing the exposure of personnel and enhancing operability.

2.4 REMOTE OPERATION

Appropriate tooling for remote operation and maintenance of equipment is an integral part of the overall system design. Small components, susceptible to loss, such as nuts, bolts, latches, and locking devices must be provided in sufficient quantities so that time is not lost searching for them. Whenever possible, the design shall include captured bolts, locks, and latches. Threaded holes shall be kept to a minimum by using dowel pins for joint strength and location. Bolt and screw rotations shall be limited to one to five turns to avoid thread engagement problems. Bolted connections, subject to dynamic loads, must be secured by safety wiring or tack welding to avoid being loosened. Blunt start threads shall be considered for remote operations where operator "feel" is limited because of manipulator or probe pole use. Fastener sizes, drive size, and type must be standardized to enable equipment disassembly with a minimum number of tools (preferably one). When a fastener is visible, identify the appropriate tool size adjacent to the fastener. For guidance for remote handling of radioactive materials and maintenance of equipment, refer to the Radiological Design Guide (WHC 1994f).

*1 gray = 1 x 10^{-2} Rads

2.5 MODULAR CONSTRUCTION

Equipment used in a contaminated environment shall be capable of being removed for repair or storage during inactive periods. To minimize radiation exposures (ALARA) to area operators and maintenance personnel, every component or system needs to be decontaminated. Drive and inspection systems shall be designed around a modular concept to facilitate removal and repair without having to disturb the structural portion of the unit. For detailed radiological information, refer to 10 CFR 835. Particular care must be exercised to ensure that modular components do not create crevices that will trap contamination and sludge.

2.6 RADIOLOGICAL CONSIDERATIONS

2.6.1 Personnel Exposure

Equipment shall be designed and procedures written to ensure that personnel radiation exposures are in accordance with the radiological control guidelines of ALARA (as low as reasonably achievable).

The design process shall consider the following criteria:

- Normal ambient radiation levels in work areas at KW Basin are maintained at 1 mrem/hr gamma or less and less than 1 mrem/hr neutrons. KE basin radiation levels are much higher (WHC 1995g). Radiological reports are updated weekly and must be consulted before performing work in the basins.

- Working radiation levels in the KW basin for short-term "hands on" operations shall not exceed 20 mrem/hr (gamma) on contact. This work is mostly surveillance or normal operation activities.

- Radiation levels up to 100 mrem/hr on contact will require justification to and approval by Radiological Controls in areas not normally accessed by personnel.

- Radiation levels on contact of 100 mrem/hr or greater shall be avoided. Special consideration, such as fixed shielding or locked access, will require reviews and prior approval by Radiological Controls.

- Implementation of any facility modifications, equipment additions or changes, procedural changes or additions, or other activities which result in personnel exposure to hazardous substances or radiation shall consider the cumulative exposure, exposure rate, and maximum allowable exposure in the design.

- Shielding equivalent to 10 ft of water shall be maintained between fuel and personnel for all in/above basin activities, except the actual filled MCO loadout from building.

2.6.2 Decontamination

It is essential to eliminate inaccessible pockets, crevices, blind holes, and rough surfaces (greater than 125 AA) that could trap contamination. All equipment used in contaminated areas and power module enclosures must be able to withstand decontamination when wiped with cloths dampened by water, soap, alcohol, or other non-hazardous materials. The surface finish on major structural components used in fuel basins, which are not subject to routine removal and maintenance, shall have a surface finish of less than 125 AA. This requirement applies to fuel basin equipment stands, fuel storage racks, and other major structural components in and out of the basins. Parts of equipment (used inside and outside the basins), which require routine maintenance and/or adjustment, shall have a finish of 63 AA or less. Remotely removable motors, mechanical actuators, or other components, which are subject to repair or periodic service, shall meet the more restrictive surface finish requirements of less than 125 AA. Because water jets (with pressure up to 15,000 lb/in.^{2} at the nozzle and flow rates up to 15 gal/min) are the primary means for decontamination in the fuel basins, the equipment, seals, and chip protectors must also withstand this force. Chemically polished or electropolished surfaces shall be used rather than mechanical machining since this type of surface is more easily decontaminated for items that will be removed frequently from the basin water.

2.6.3 Contamination Containment

1. The primary method of controlling contamination should be by controlling the radioactive material at its source.

   A. Features that minimize the buildup of contamination and which facilitate clean up shall be implemented in facility design and modification.

   B. Where possible, physical measures such as ventilation, encapsulation, hoods, enclosures, gloveboxes, hot cells, etc. shall be used as the primary barrier to contamination.

      1. When selecting equipment or materials for use in contaminated areas, considerations should be given to:

a. Interior surfaces that minimize the buildup of contamination and facilitate decontamination.

b. All cracks, crevices and joints should be sealed or covered to present a smooth surface.

c. Avoid the use of porous construction materials, i.e. wood, concrete, sheet metal panels, etc.

2. Containments for contamination control are used to minimize personnel contamination, prevent the spread of contamination (control it at it's source), and minimize or remove the need for protective clothing and protective equipment. The use of containments should be considered whenever the task involves the potential spread of contamination, exposing a contaminated fluid or system, or airborne contamination emission.

a. Containment is not limited to the concept of total enclosure, but instead encompass the application of engineered barriers, applied in varying degrees, to prevent the spread of contamination; establish the contamination barrier as close to the source as possible, and use containments around the work area instead of requiring workers to use additional protective clothing or other personal protective equipment.

b. Engineered barriers can vary, and limited only to the imagination of the person designing them. They can include such items as containment tents, glove bags/boxes, catch containments/drapes, wind breaks or bull pens, polyethylene (poly) bottles, air curtains, or other devices.

c. Selecting the appropriate containment should use a graded approach based on anticipated contamination levels, contamination stability, work activity involved, and risk inherent in the activity.

d. Contamination control should always be the main design objective, but other considerations such as temperature, area configuration, tools to be used, isotope(s), and radiological characteristics of the immediate area are just a few of the other items to also be considered.

C. When unable to contain radioactive material at the source, contamination should be controlled by engineered barriers so as to preclude its escape from its radiological area, especially to non-contaminated or non-radiological areas.

D. Planning for potential decontamination must be made for any operation involving radioactivity. Good housekeeping is also integral to good radiological work practices. The work area must be kept neat and clean both during the process and after its completion. Any job should return the work area to a condition at least as radiologically clean as before the project, if not able to be free released. These housekeeping steps should be a written part of any radiological work package. Disposal and storage of radiological waste generated during the performance of the job should also be written in the package.

E. Prevent the items from becoming contaminated.

1. Coatings, and coverings.

2. In process decontamination.

3. Precise contamination work control and radiological controls monitoring.

4. Reutilize materials that were previously contaminated.

2. Use special radiological tools such as HEPA filters, filtered/vacuum shrouded tools, spot ventilation, special monitoring, etc., to capture or control contamination.

2.6.4 Dose Mitigation

1. Radiation exposure can be:

A. External dose- (whole body, skin, extremity) All or part of the body can receive dose delivered by a source which is outside the body.

B. Internal dose- (inhalation, ingestion, absorption, injection) Delivered to the body tissue from radioactive material present inside the body.

C. Internal and external dose is combined to calculate total dose.

2. Temporary shielding

A. Radiation levels in the work area may indicate a need for temporary shielding to decrease dose rates and worker total exposure.

1. There should be an evaluation to determine the feasibility of the system to be able to support the shielding.

2. The exposure required to install and maintain the shielding must be calculated and compared to anticipated dose and exposure reduction to ensue a net benefit.

3. Normally the Radiological Controls or ALARA (As Low As Reasonably Achievable) organization will identify the need for temporary shielding and assist in its consideration and requirements.

B. Utilize material or components that are in the area for purposes other than shielding and utilize their presence for shielding purposes.

C. Sequence the shielding for the expected radioactive components and attenuation of differing types of radiation expected to be encountered.

3. Source Reduction

A. Design with materials that will reduce the formation of CRUD (Corrosion or erosion of equipment in or near a neutron flux may produce small free bits of steel or other metal that can be activated and collect in low flow areas of fluid systems. This is commonly referred to as CRUD.)

1. Reduce erosion of material by using good flow geometry.

2. Reduce corrosion loss by pre-treating or pre-coating surfaces, pH and other chemistry controls, and providing for wet lay up.

3. Introduce and maintain a passive oxide layer.

4. Reduce deposition by selecting appropriate flow velocity, use of strainers and filters, ensuring that all piping and system low points are flushable and have drains, design piping systems with a minimum of pipe fittings, minimize crevices, low points and dead legs, connections located above the centerline of the pipe, valve selection considering internal materials and configurations that minimize crud and hot spot buildup, stems located upright, avoid cavities in valves, straight tube vertical heat exchangers, use butt welds, consumable inserts and freeze fittings that produce smoother welds, etc.

B. Decontamination

1. Outer surfaces

a. Strippable coatings- They can also be used to prevent the item from becoming contaminated as well as remove contamination after the fact.

b. Fixatives

c. Chemical methods

d. Mechanical methods

2. Inner surfaces

a. Corrosion resistant materials

b. Chemical treatments to prevent the material from becoming contaminated or corroded.

c. Chemical/Mechanical treatments to remove contamination or corrosion.

C. Source elimination- substitution of other technologies or materials.

D. Decay-If practicle, allow the radionuclide(s) to decay before handling, to decrease the radiation field.

4. Consider the effects of radiation scatter, streaming, and skyshine in the performance of the task and in the general work area.

5. Maximize the distance from a radioactive source

A. Consider the location that the task is to take place.

1. Have a gradient survey performed to determine the radiation field configuration. This will better determine positioning of personnel and equipment to maximize low dose rate areas and shielding/shadowing of radiation sources due to the areas configuration and installed equipment.

B. Consider the use of special tooling that increases the workers distance from the source.

1. A radiation fields intensity drops off proportionally to the square of the distance from the source. (A tool that increases a workers

distance from the radiation field, yet doubles the time required to perform the task may yield significant dose savings.)

C. Select low dose areas for installation when possible.

D. Segregate radioactive and non-radioactive components.

E. Provide provisions for removal of components to low/no dose areas for maintenance.

F. Locate all non-radioactive components in low dose areas (instruments, breakers, power centers, etc.)

G. Use remote operation when possible.

H. Route piping carrying highly radioactive fluids away from equipment requiring frequent maintenance.

I. Use cameras, microphones, and other transmitters to perform remote inspections and surveillance.

6. Minimize the time in a radiation field.

A. Can part or all of the task be performed in a low/no dose rate ares?

B. Mark hot spots and low dose stand by areas for worker use.

C. Conduct mock ups for complex, high dose, or first time tasks to work out problems and become proficient in the task.

D. Compile material staging lists and pre-stage materials at the job location. The materials and tools required for the task are compiled from the mock ups.

E. Consider special tools that will make the job progress smoother or quicker.

F. Use equipment with proven reliability and proven ease and low frequency of preventative maintenance.

G. Use equipment that requires less frequent calibration, inspections, and testing.

H. Provide adequate clearance for maintenance and inspection around components.

I. Provide flanged connections or quick disconnects where possible for items that might require removal from the radiological area for repair or calibration.

J. Install permanent lighting and platforms so that time is not spent erecting and removing temporary scaffolding.

2.7 SPECIAL DESIGN CONSIDERATIONS

2.7.1 General

Everything possible must be done to minimize the number of special or unique tools required to operate and maintain equipment (maximum durability and simplicity). Equipment must be designed for minimum weight and complexity, maximum visibility and standardization of parts. This may include newly designed extensive, complex systems or fabrication and testing of a prototype. The K Basins projects group will perform seismic evaluations for K Basins-designed equipment. For sponsor-supplied equipment, the cognizant K Basins engineering group must ensure this assessment is completed before construction.

Fuel basin equipment, which may be transferred through the fuel basins, must be designed so they do not float. All equipment containing hollow spaces shall be float tested. Remotely installed equipment modules shall be designed so their buoyancy does not affect proper installation. Also, basin hydraulic equipment will use an approved basin water-compatible hydraulic medium.

2.7.2 Fuel Handling Equipment/Facility Modification Guidelines

1. Fuel handling equipment is defined by any one of the following criteria:

   A. Equipment that lifts or moves fuel.

   B. Equipment that imposes forces on the fuel that must damage or change its geometry sufficiently to alter criticality control considerations including applicable inspection and measurement equipment.

   C. Equipment that provides geometric spacing to assure nuclear safety.

   D. Radiological systems monitoring that is required for fuel movement.

   Note that simple supports, such as tables, floors, fixed platforms, etc., are not generally considered fuel handling equipment.

2. Modifications:

Facility modifications are defined as changes made to structures, systems, components, or procedures during any phase of the life of the nuclear facility. Facility modifications, which are included in the work scope forecasted for K Basins and Spent Nuclear Fuel project staff, relate to safe storage and path forward activities only. Modifications will be made to prevent or offset structural damage to facilities caused by seismic activity or other natural or unnatural disasters. Facilities must be in compliance with applicable requirements to enable progress in fuel movement activities. For example, modifications to the KE Basin water circulation and filtration system will be evaluated for cumulative effects that may affect the safety and design basis of the system. An Unreviewed Safety Question evaluation must also be considered before making modifications. Monitoring will be done to ensure safety. Relocation of existing monitoring equipment may be considered with the approval of appropriate cognizant and radiological engineers. To relocate most equipment, an engineering change notice is required.

Facility modifications and fuel handling equipment must be designed so that compliance with environmental regulations, nuclear safety, and safety analysis reports and Operational Safety Requirements is maintained throughout the handling process and in case of accidents.

All facility modifications and fuel handling equipment designs require forms and checklists to be completed as part of the design documentation. The K Basins Equipment Completion And Facility Modification Checklist (see Attachment 2) will be completed according to a timetable established by the cognizant project engineer related supervisor. It is required before placing equipment in service. For other review process descriptions see Attachments 1 and 8 and Figure 5 of the <u>Engineering Practices Guidelines</u> (WHC 1994b)

2.7.3 Equipment Disposal

All items must be easily disposable and must be dry for disposal in standard waste box. Underwater equipment must be able to be remotely disassembled into components that can fit into a standard 4 ft x 4 ft x 8 ft, 5,000 pounds maximum gross weight plywood box (refer to Drawing H-1-42701, Rev. 3 [WHC 1991]) for disposal at the Solid Waste Management Complex. For other equipment used inside and outside the basins, the design engineer must consult the solid waste management organization and refer to "Hanford Site Solid Waste Acceptance Criteria" (WHC 1995b) to ensure that equipment components are held to the proper size. Hazardous materials must not be used.

In addition, drain holes shall be provided to remove water, and equipment shall be designed to limit contamination traps.

2.7.4 Monitoring Equipment

The Area Radiation Monitoring System, also known as the Programmable Input/Output Processing System, shall be in service when fuel handling activities are performed. Fuel handling activities can cause unexpected changes in basin radiation levels. The Aerial Radiological Measuring System requires that radiation detectors be installed in locations with the potential for unexpected increases in dose rates (WHC 1994c). Equipment used for radiological monitoring, shall not be blocked or shielded by the installation of new equipment or by modifications to existing equipment.

2.8 PRECISION ALIGNMENT

Precision adjustment or alignment requirements that can be performed only during equipment installation shall be avoided, as this can lead to additional removal of fuel basin equipment. Vertical alignment shall be within plus or minus 1/2 inch (in.), and horizontal alignments shall be within plus or minus 2 in., unless already approved by K Basin operations.

Mechanical equipment in the 105 KE and KW basin buildings (outside the water), which requires precision alignment, shall be documented as such and will use position information as referenced from floor and wall benchmarks adjacent to the KE and KW discharge chutes. Refer to drawing number H-1-21051KE and H-1-21051KW (BHI 1955).

2.9 EQUIPMENT MANUAL

Equipment intended for use at K Basins requires a manufacturer-provided equipment manual that defines testing, operation, diagnostic trouble shooting, maintenance, refurbishment, and modification of the equipment. This manual shall be part of the documentation required by the Equipment Completion Checklist (see Attachment 2) and shall be copied and attached to the checklist for access of all personnel.

2.10 K BASINS SYSTEM CAPABILITIES AND PARAMETERS

Except in unusual circumstances, equipment must be designed to be installed and operated by already existing facility services. Facility characteristics most likely to affect equipment design are listed below.

2.10.1 K Basins Facilities

Refer to Interim Essential and Support Drawing List for K Basins (WHC 1994d) for system drawings. Design loads for facilities are identified in Hanford Plant Standards, SDC-4.1 (DOE-RL 1989) and Guidelines for Assessing the Seismic Adequacy of Safety Class 3 and 4 Equipment at the Hanford Site (Ocoma 1992).

30 Ton Crane - Fuel Transfer Bay: (See Drawing [H-1-21272] [WHC 1955a) for details).

High bay cranes are mounted on rails 26 ft 6 in. above the finished floor elevation. The dimension between hook eye center at the upper most limit switch setting of the crane to floor in KW Basin is 22 ft 9 in. KE Basin hook to floor dimensions and other dimensions for both basins are contained in a 1995 work package, J3-1K-95-00785.

Rigging gear for fuel basins operations shall be designed and sized to ensure that crane hooks, strongbacks, spreader bars, and equalizers are not submerged during use. Carbon steel slings, shackles, eyebolts, and hooks are routinely used to install and remove items from the fuel basins. All rigging gear, which is submerged for an extended time, shall be carbon steel.

New Cranes

New cranes and repairs, where applicable, shall be designed to meet the requirements of the Hanford Site Hoisting and Rigging Manual (DOE-RL 1993) and the Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder, ASME-NOG-1 (ASME 1989) Type 1 or Type 2.

Fuel Basin Floor Loading

The floor loading for the fuel basins floor is 1850 lb/ft^2, and loading for adjacent surfaces is illustrated in Structural Feasibility of Spent Fuel Consolidation at 105 KW (Winkel 1994), and K Basin: Floor Loads and Calculations (Giller 1995).

Anchor Bolts/Core Drill Permit

Anchor bolts shall be designed and installed in accordance with DOE-RL (1989) using 3,000 lb/in.^{2} concrete. Anchor bolts, which are installed in concrete with a depth greater than 2 in., requires a core drill permit. The core drill permit (see Jet Form A-5680-118) requires the approval of the K Basin cognizant engineer, radiological engineer, and operations.

Fuel Canister Movement Within the Basin

Fuel canisters are moved within the basin by canister hooks. Canister hooks are designed to move one fuel canister at a time. The hooks, which are supported and operated by hoists traveling on overhead monorails, are moved through the slots in the metal grating forming the working platform over basin water. Slots in the basin grating are 1 1/2 in. wide (refer to drawing H-1-21007 [WHC 1956]). There are two basic types of canister hooks: a straight hook and an offset hook. (Refer to drawings H-1-44932 (WHC 1983), H-1-34706, and H-1-34707 [WHC 1986].) The straight hook is used to lift canisters positioned below the slots in the grating. Offset hooks are used to lift canisters that are not directly below the slots in the grating. Offset hooks are equipped with an integral counterweight attachment that compensates for the moment reaction resulting from the canister assembly center of gravity being at a horizontal distance away from the hoisting point.

Hooks are designed to limit the amount of vertical travel that a fuel canister can be subjected to when being lifted out of the canister storage racks. There must always be at least 10 ft of water covering the fuel during normal fuel handling operations. The 8 ft water cover is a requirement in Section 4.2.1 of the Operational Safety Requirements (WHC 1993a).

Shop Services

- Electrical Power -(±) 5 voltage variability
  - 120 VAC Single phase equipment - 20 amp receptacle with ground and a 16 amp maximum load.

    If a ground fault current interrupter is required, it must be supplied with equipment.
  - 208 VAC 3 phase equipment - 24 amp maximum Crouse - Hinds Co. number AR342, 3 wire, 4 pole, style 2. (Very limited availability. Engineering management approval required before selecting.)

    There is no 220 volt single phase. Do not use or specify.
  - 480 VAC 3 phase equipment - 40 amp maximum Crouse - Hinds Co. number AR642, 3 wire, 4 pole, style 2.

    There is no 125 VDC available in the basin.
- Water
  - Deionized water is available (12 gal/min at 30 lb/in.^{2}); its addition to the fuel pool is strictly regulated.

Filtered water is available but not recommended for continuous use. (Continuous use over a long period of time would negatively affect the ion exchange modules.)

Processed basin water (filtered and deionized) is not available for use. Plans are underway to provide up to 100 gal/min of 25 to 35 lb/in.^{2} (gauge) of processed basin water for general use. The type of end connections for hose bibs has not been determined.

The existing process piping is carbon steel (see Attachment 5).

Air

- Service Air -105 KE. The system consists of a 7.5 horsepower (HP) electric air compressor (26 cubic feet per minute [ft^3/min] but it must be derated for continuous use), one 216 ft^3 air receiver and an aftercooler (Hankison model AC75 rated 365 # SCFM at 250 °F at 15 °F approach). Outside isolation a 2 in. valve (CAV-1E-017) provides easy access to charge the system with a temporary engine driven compressor. Air quality due point is only controllable with the after cooler. System is described on H-1-51837 Sheet 6, Rev. 1 (WHC 1995), which is a P&ID of the air system. The system in 105 KE has been modified to allow future installation of a 40 HP (160 ft^3/min) electric compressor, which is purchased and available for installation. Minimal service air is available for additional activities.

- Service Air -105 KW. Although the pipe air leakage and general condition is unknown, the system was functional three years ago. At 105 KW, the system is not currently operating.

  - 105 KE and 105 KW. No breathing or instrument air is available.

- Revisions and modification to the compressed air system piping will be designed to meet ANSI/ASME B31.9 (Building Services Piping) with a design pressure of 125 lb/in.^{2} at 200 °F and an operating pressure of 100 lb/in.^{2}. Any pressure vessels shall meet ASME B31 section 8, Boiler and Pressure Vessels Code (ASME 1992).

- System classification. Compressed Air

  - Safety classification of major components (receiver tanks and safety relief valves) is Safety Class 3

  - Safety classification of piping 1 in. and smaller is Safety Class 4

  - Safety classification of piping greater then 1 in. is Safety Class 3

- Safety classification of compressed gas cylinders is Safety Class 3

The safety classifications shown above are currently correct with respect to WHC-CM-4-46. However, the classification criteria and method will likely change in the near future. The changes may include characterizing systems in safety classes, non-safety classes and other. These guidelines will be amended as appropriate, but it may be advantageous for design groups to consider future classifications to avoid complications.

- Basin space heating in below-freezing weather may become a concern if large doors are opened. The heating boiler rated capacity is 500,000 British thermal units (Btu) per hour. The distribution efficiency is unknown; and effective output maybe less. The building heat loss rate is undetermined. Freeze problems have occurred in the past. The total airflow through the building varies between a rated capacity of 4 exhaust fans totaling 34,000 ft^3/min to 53,000 ft^3/min with doors open and all fans on. Air flow measurements are published in Test Report: 100 K Basin Airflow Effluent Volume Test (WHC 1993b), for 1993 air permitting reports. Small instrument and sample line and nonflowing water lines have historically been the problem with freeze-up.

- Valve equipment, and major electrical numbers etc., shall be unique within the K Area site. Identifiers are assigned by the responsible cognizant system engineer within K Basins, and different data bases are maintained to assure the identifiers are unique and consistent. Numbers are assigned to nonportable equipment that is intended to function within a system for an extended time. When questions are raised about the need for identifiers, the appropriate system cognizant engineer shall make the decision. See section 2.12.

Wall Contours

- The surfaces of vertical walls and floors in the fuel basin may vary in flatness and plumb within a two-inch envelope. Equipment on the floor or attached to walls must compensate for these variations.

Fuel Basins Environment

- The water temperature is controlled at 46 to 53 °F, a maximum temperature greater than 70 degrees can be reached when basin chillers are shut down. The safety analysis report documents 100 to 130 °F, but practical experience suggests the water temperature will not reach that temperature.

  The water pH range is 5.5 to 7.5 nominal and 5.0 to 9.5 maximum (Operational Safety Requirements)

  Particle Sizes. The majority of the particles in the water samples have diameter ranges less than two micro meters. Most of the particle mass resides in diameter ranges above 20 micro meters. The basin water sample likely contains particles with the diameter less than 0.5 micro meters, which would not be detected by the instrument.

  The water conductivity is KW 1-2 uS and KE 3-5 uS typically.

  Water contamination levels are as follows:

  - KE Basin

Cs-137	2 uCi/L typical
Sr-90	1 uCi/L typical
Alpha	4e-2 uCi/L typical

  - KW Basin

Cs-137	.1 uCi/L
Sr-90	6e-3 uCi/L
Alpha	2e-5 uCi/L

  Impacts on water chemistry and water treatment systems.

  The K Basins are filled with demineralized water. Mixed bed ion exchangers, which are used to remove all ions from the basin water, control radionuclide concentrations and maintain water chemistry. Offline or to be used cartridge filters, which are used to remove particulates from the water, control radionuclide concentrations and maintain water clarity. Additions of chemicals to the basin water, whether intentional or accidental, will have a significant impact on water chemistry and the integrity of wetted components in the basin.

  The intentional addition of chemicals falls into the categories of algae control (algaecides, chlorine or hydrogen peroxide), pH adjustment (acids or bases) or water clarification (flocculent and clarifiers). Chemical additions must take into account the impact on corrosion of wetted materials (high chloride concentrations will accelerate the corrosion of aluminum, copper and carbon steel), the water treatment systems (acids and bases would increase ionic burden for ion exchange systems), and basin waste volumes (flocculent would increase the volume of sludge requiring disposal or would shorten the life of cartridge filter assemblies).

A variety of products such as lubricants, sealants, and hydraulic fluid could be released into the basin water because a component, which is emersed in the basins, fails. Equipment must be designed to minimize the potential of such releases. In addition, chemical products must be selected so that they do not impact basin water treatment components seriously (i.e., fouling or plugging ion exchange media, filters, etc.), alter water quality parameters (pH, conductivity, water clarity), or cause a surface film or bathtub ring to form. Process Standard C-303 discusses acceptable materials that can be added to the basins.

The hazard category of any item, which is intentionally added to basin water or could be released accidently into the basin, must be screened to assure there is no potential for the basin water or basin waste stream to be designated as hazardous or mixed-hazardous waste.

Shielding

- Shielding and confinement are used on a case-by-case basis to meet ALARA guidelines for radiation exposure to the worker and releases of radionuclides to the air. Each case will have its own parameters. Activities which have the potential to increase air, water, or ground emissions from the facility will be documented and presented to WHC, K Basins Safety and permitting personnel.

Rail Service

- There are three metal rollup doors on the west wall of the transfer area in the 105 KE and KW Basins. Each door has an identification number. The door locations (155, 156, 157) are identified on drawing H-1-21001 (WHC 1955a), the corresponding sizes are listed in Table 2-1. If you are outside the basin west wall and looking east, door 155 is on the left (north end), door 156 is in the center, and door 157 is on the right. Doors 156 and 157 are the largest and roll up higher to allow railcar access into the building. Although rail tracks lead into both doors, only door 157 provides full rail access into the transfer area of the building. The track spur into door 156 is not intended for use. Inside door 156, a rail bumping post, affixed to the tracks, prevents a train from entering further. The bumping post was installed according to drawings H-1-45071 (WHC 1984) and H-1-45072 (BHI 1989) for KE and KW basins, respectively. The post protects the ion exchange modules from any railcar that inadvertently might be switched onto the spur track.

  Truck access into the basin transfer area is through door 155 or 157. The dimensions are documented in the work package J3-1K-95-00785. Only one railcar (well car) and locomotive combination are allowed through door 157 at any given time. The combined weight of the car and locomotive cannot exceed 470,000 lbs (WHC 1994g). Additional requirements are in the Operational Safety Requirements (WHC 1993a).

The recently completed draft document K Basin Rail Control System Structural Evaluation (WHC 1995f) recommends that changes be made to the Safety Analysis Report (WHC 1994g) concerning the basin rail system. Field walk downs have been part of an effort to generate a comprehensive as built drawing of the existing rail system. The drawings are still in development.

Door Access

- The doors into the K Basins are shown on drawing H-1-21001 (WHC 1955a) and Table 2-1.

Table 2-1. K Basin Door Sizes.

Door	Width (ft)	Height (ft)	Height by limit switch setting
147	8 ft	9 ft 11 in.	TBD
148	9 ft	10 ft	TBD
149	8 ft 9 in.	13 ft 6 in.	TBD
155	12 ft	18 ft 10 in.	TBD
156	14 ft 6 in.	22 ft 2 in.	TBD
157	14 ft 6 in.	22 ft 2 in.	TBD

2.10.2 General Purpose Tools and Containers

Few general purpose tools are available for use in the basins. Most of these tools are fuel handling tongs, canister hooks, and a small number of custom-made tools consisting of poles with various attachments. Some commercially manufactured, pneumatically-operated tools manufactured by the Master Lee Company were supplied by a vendor (contractor) during sludge and debris removal activities. It is not prudent to assume these tools will always be available and in good working order. Before using, tool availability and condition shall be verified by a field inspection.

The most available and common containers are clean, empty MK-I and MK-II fuel storage canisters. If containers other than empty fuel storage canisters are needed, they will have to be fabricated. Design considerations shall consider hoisting system limitations such as weight capacity and travel distance. Additional limitations are imposed by the width of passageways in the water-retaining portion of the basin structure. Containers capable of trapping air shall be tested before using to ensure the container has negative buoyancy.

2.11 WASTE GENERATION

Design goals include minimizing the use of corrodible materials and the size and number of contaminated parts. All parts shall disassemble into 8 ft. sections or less and be drained before removal from the basin. Contaminated tools and equipment shall be a size that allows wrapping/sealing of surface contamination in place when removed from or transferred between basins. Crevices, joints, and gaps, which allow water to remain attached because of surface tension, shall be minimized.

Equipment and tools will be evaluated for effects on increasing airborne emissions from the facility and waste costs during the design review.

2.12 EQUIPMENT NUMBERING AND LABELING INSTRUMENTS

Mechanical equipment installed for plant operation will be identified by standard designator and abbreviations used in ASME Y1.1 (ASME 1993) and on all drawings and sketches. Permanent noncorrodible markers will be attached to equipment, or permanent marking will be done. The K Basins Cognizant Engineering Equipment Identification program will approve all designators.

Piping/valving >1 in. nominal, which is not sample or instrumentation lines, will be identified and designated according to the K Area Valve and Line Identification program currently administered by the K Basins Cognizant Engineering group. Permanent noncorrodible markers for line identification will be attached to valves and lines.

Instrumentation and control devices, which are <1 in., will be identified and designated according to the K Area Instrument Identification program currently administered by K Basins Cognizant Engineering group. Designators will be according to ANSI/ISA S5.1 (ANSI 1992). Tag information, which is to be contained on permanent noncorrodable markers, will be attached to equipment.

For additional processes involved in numbering and labeling, see Attachment 4, Sections 6.6 and 8.6.

2.13 JOB CONTROL AND PREVENTATIVE MAINTENANCE/SURVEILLANCE

The Job Control System is the computer maintenance management system at the Hanford Site. It provides a database of information about a plant, facility, and/or equipment. The

Job Control System Automated Data Processing users guide provides the procedures necessary to access and utilize the Job Control System Automated Data Processing application in support of the WHC-CM-8-8 and WHC-CM-1-8.

Preventive maintenance and surveillance is also covered in the Job Control System. The Preventive Maintenance/Surveillance system offers an activity file, reports, and automatic work order generation. Engineers should contact K Basins Work Control Organization to clarify job control, tracking, preventive maintenance, and scheduling questions.

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3.0 MATERIALS

3.1 ACCEPTABLE AND PROHIBITED MATERIALS

It is necessary to control materials that may contact nuclear fuel or irradiated components because of the effect that intense radiation or decay heat may have on the material properties or because of adverse effects that the materials may have on the fuel. K Basins Process Standard (WHC 1995e) C-303 discusses materials that can be added to the basins.

In addition to controlling materials that may contact fuel or irradiated components, some materials do not work well because of their corrosion or decontamination characteristics.

3.1.1 Aluminum

Aluminum has problems with corrosion and decontamination. When used, structural failures of fuel basin equipment caused by corrosion has occurred, particularly in welds, and aluminum is difficult to decontaminate. For these reasons, aluminum shall not be used in fuel basin equipment unless it can be justified for a particular component. When using Alloy 2024-T4, care must be taken to avoid any process which might heat treat it and result in a loss of annealing. Alloy 2024-T4 has good strength and properties and is now being used at K Basins. When used in fuel basins, aluminum must be protected against abrasion (which accelerate corrosion), galvanic corrosion, and stress corrosion cracking. Weld design and fabrication must also be tightly controlled. If aluminum is used, it shall be anodized to MIL-8675 Type 3 class (to color required), or powder metal coated or fusion bonded with a polyester powder.

3.1.2 Carbon Steel

Carbon steel materials are acceptable in the K Basin demineralized water environment.

3.1.3 Plastics and Elastomers

Although these materials are useful in many applications, there are problems that must be avoided. Plastics and elastomers have a strong affinity for particulate contamination, which will migrate above water level on items which break the fuel basin surface. This can lead to airborne contamination and increases in work area radiation levels. Therefore, plastics and elastomers shall be avoided on components subject to frequent removal from the water or which penetrate the fuel basin surface. While hard, glossy paint coatings are not as subject to these problems, they are not as good as stainless steel. Cables or hoses that break the water surface shall have a stainless steel tubing sheath near the water surface. Polycarbonate is particularly useful for fixtures and window protectors. In all applications, degradation caused by radiation must be evaluated. Schedule 80 PVC is an acceptable material for the demineralized/deionized water distribution within the basin. Preferred material for high exposure includes PVDF piping, and HYPALON, and EPDM hookup wiring.

3.1.4 Stainless Steel

Most applications in the fuel basins can be protected by using stainless steel alloys. Stainless steel, often referred to as corrosion resistant steel, usually involves the 300 series alloys and 17-4 PH. The latter is a precipitations-hard alloy which is procured and heat treated at least three levels.

Threaded joints in 300 stainless steel preferably are made using Nitronic 60, a galling and wear-resistant stainless steel, as the fastener to avoid galling. This material, commercially referred to as Nitronic 60, can be ordered by commercial standards as ASTM-A-276 grade UNS S-21800. Refer to Section 4.1.2 for more information on threaded fasteners.

3.1.5 Materials Affecting Criticality

Materials affecting the reactivity of a fissile fuel component, require a criticality safety evaluation report, which is reviewed and approved by Westinghouse Hanford Consequence Analysis and Spent Nuclear Fuel Safety. These materials include moderators (e.g., poly, water, and wood), poisons (e.g., boron and hafnium), and reflectors (e.g., concrete and lead). Lead shall be avoided in equipment design because of its extremely high reflective properties. However, lead can be jacketed in contaminated areas, and the jacket can be removed and disposed of as radiation waste. This prevents the lead from becoming contaminated and requiring disposal as mixed hazardous waste.

4.0 MECHANICAL AND ELECTRICAL

4.1 ACCEPTABLE COMPONENTS

The purpose of this section is to provide information on the components that K Basins has found acceptable and those which have had problems. There is no intent to restrict components already found acceptable, although operation and maintenance are simplified by choosing components already in use. New components require more testing and debugging before being placed in a contaminated environment to ensure adequate overall equipment reliability.

4.1.1 Structural Components for the Basins

Most equipment not requiring disassembly for storage, maintenance, or disposal shall be welded. This minimizes crevices that trap contamination and increases the likelihood of maintaining the integrity of anticorrosion coatings. Structural subassemblies shall be fastened together or aligned with dowel pins or other nonthreaded fastening systems. Equipment support structures shall be designed to be remotely installable, and all adjustments or alignments shall be made from overhead with simple probe-pole tools or remote manipulators. Hollow structural members shall have drain holes drilled or drain plugs installed to ensure that all water drains when the item is removed from the water. Welded seals occasionally fail and shall be avoided when used to seal a hollow structural member.

Lift beams and strongbacks must be made of stainless steel to assure that surface conditions and polished welds will meet the Westinghouse Hanford lifting standard, quality assurance inspection.

4.1.2 Mechanical

Threaded Fasteners

The design of threaded fasteners, used in the fuel basins, demands careful attention to galling and corrosion problems. One-use fasteners can be 300 series stainless materials for both components as long as they can be assembled with an acceptable lubricant. Fasteners subject to frequent use must be capable of repeated assembly without lubricants other than water. Fuel pool use and galling research indicate that 300 and 400 series stainless steels have excellent gall resistance in threaded joint applications when mated with Armco Nitronic 60, a patented corrosion-resistant specialty steel described in Section 3.1.4. Nitronic 60 also has high galling resistance when self-mated. Although bolt-thread chrome plating can prevent galling for one-time assembly of a stainless steel joint, the plating may gall and seize more severely than a stainless-on-stainless joint, if used for multiple assembly applications. All fastener head sizes shall be at least 3/4 in. (if possible) to ease remote handling. Efforts shall be made to keep head sizes to either 3/4 in. or 1-1/4 in. to minimize the fuel basin tools required. Coarse series threads are preferred, and uniformity in fastener size and length is requested. Blunt start threads shall be considered for remotely-operated fasteners. Locking of threaded fasteners shall be used only where required and shall be a simple, torque override type (e.g., thread locking compounds, lockwashers, elastomer element selflocking nuts, etc.). Lockwiring, locking cups, deformed-thread self-locking nuts, and lockwelding shall be minimized. All fasteners, intended for remote operation in the fuel basins, shall be designed for overhead access with a probe pole. Class 2 thread fits and conical shaped hex head bolts shall be used in all cases. Fastener installation at right angles shall not be used. If straight up and down access is not possible, ball conical heads shall be used.

Components, on which sockets will be used remotely, shall have a conical lead-in to aid tool engagement. See Oak Ridge National Laboratory/TM-10864 Section 4.9.4 for detailed information. Fasteners shall be torqued to the turn of the nut method (Chenault 1993).

Bearings

- Sliding element bearings. Standard lubricant-impregnated sintered metal bushings and sliding elements are acceptable for above-fuel basin use, but cannot be used in the water because of the possibility of oil contamination. Aluminum bronze bushings are acceptable for light-load use and bronze bushings for even lower loads. Nylon and other nonTeflon plastics are acceptable bearing materials provided 1) they are not exposed to extreme radiation, 2) they are protected against machining chips and other hard debris, 3) they are sized to allow for pit operating temperature, and 4) appropriate allowances are made for swelling caused by water absorption. Nylotron™ has been tested and is good to 1×10^8 rads accumulated gamma dose. DELRIN™, which has extremely poor resistance to radiation, is prohibited.

- Rolling element bearings. Standard sealed, permanently-lubricated bearings are acceptable for above-water use, but they cannot be used in the fuel basins because of corrosion and oil contamination. Fuel basins bearings shall be 440C material; they can be lubricated only if oil contamination in the fuel basins is highly improbable. This can be accomplished by placing bearings in watertight compartments such as gearboxes or motor housings on large machine tools. Sealed 440C bearings with nonwater-soluble lubricants occasionally have been used successfully (e.g., underwater bandsaws), but adequate testing must be performed to verify there is no oil contamination before installing equipment in the fuel basins. Any bearing element must be able to withstand normal soap and water decontamination for maintenance. If possible, bearing seals shall be made from radiation-resistant materials.

Actuator and Drive System

All actuator and drive systems shall be modular so that the system can be removed or so that components can be replaced without removing the system. They shall be standardized as much as possible. Systems-oriented design shall enable the repair of the equipment to be accomplished with few interchangeable parts.

Although electrically-operated actuators and drive systems are preferred for above water use, the need to isolate such components from the water in the fuel basins makes their use there more difficult. Waterproof housings increase maintenance difficulties and are often hard to seal, particularly in larger sizes. Hydraulic systems using water as a working fluid have been successful, but only the most basic components of these systems are available in water-compatible materials. Pneumatic systems are acceptable as long as air is kept in a closed cycle system or is exhausted above water to prevent bubbling. The exhaust line in this type system must have a high efficiency particulate air filter attached.

If at all practical, all electronic and electrical systems shall be above water and in the radiological controlled area instead of a controlled surface contamination area. A design review by electrical engineers is required if the preferred location cannot be used.

Gear and thread operated actuators in fuel basin service must be downrated to compensate for the poor lubrication provided by water, and because extensive testing is generally required to ensure trouble-free operation. Good results can be obtained with ball screw precision positioning systems fabricated from heat treated 17-4 PH stainless steel. These systems function best in a fuel basin environment when lubricated with a nonwater soluble lubricant.

4.2 ELECTRICAL

All electrical work performed at K Basins shall meet NFPA 70 (NFPA 1993).

4.2.1 Radiation Resistant Wire

Radiation-resistant wire shall be used on equipment where the wire itself is subjected to high radiation (high radiation fields as defined in section 4.2.6) fields. This wire shall be used in radiation fields throughout the facility, but primarily in the basins. Beldene PVC chrome and Alpha Omni I, II, and III have been tested at the Test Reactor Area (Idaho). Though Raychem radiation-resistant wire can be used, the design group should examine the advantages and disadvantages closely.

- Hook up Wire (radiation resistant):
  - Meets IEEE-383 Class 1E or approved equal
  - 30 to 2/0 AWG wire size

- Assorted colors available
- Up to 50 pairs twisted and shielded cable
- Withstands 2×10^8 rad (2×10^{10} grays)

- Coax Cable (radiation resistant):
  - Use stranded center cable for flexibility
  - RG-59/U or equivalent standard size coax
  - Withstand 2×10^8 rad (2×10^{10} grays)

- K Basins recommends radiation-resistant wire for applications where remote replacement is not practical and where intense radiation levels are anticipated. With proper evaluation of the application, it has been found that these situations seldom occur. Radiation-resistant wire, with its specially fabricated insulation, is less flexible than normal control wire. It shall be considered where criteria are met, and where flexibility is not a requirement. All cables shall use Amphenol or LEMO type connectors for quick replacement.

  Wire used outside radiation areas (radiation areas as defined in section 4.2.5) will meet Underwriters Laboratory standards and requirements.

4.2.2 Wire Identification

For identification purposes color-coded wires and wire number tabbing are preferred to identify wire. The standard color code used at K Basins is MIL-STD-681. Color-coded wires normally reference Amphenol pin numbers or terminal strip numbers (e.g., pin number 2 would be red for the color code 2). This system aids the instrumentation technicians when troubleshooting.

4.2.3 Cable Connectors

K Basins uses manual switch (Amphenol) and LEMO type push-pull quick-disconnect connectors. Contact pins are noncorrosive and connectors are impossible to misconnect. The screw on feature of the Amphenol and the push-pull connect feature of the LEMO have advantages which make them well suited to remote applications. The specific application will determine which type of connector is best. LEMO connectors smaller than size 2 shall not be used.

Connectors are available which handle up to 40 amps and have from 2 to 48 pins. Contact the K Basins Cognizant Engineering organization for standard sizes and types.

4.2.4 Tygon Tubing

Tygon tubing is used at the 100 K Area in the fuel storage basins. Tygon tubing provides water tight electrical connections from the top-side to various machines. A pipe nipple is located on the underwater machine, and the tygon tubing is sealed with stainless steel hose clamps. The other end is potted with Hysol-type epoxy. The encapsulated conductor cable extends approximately 8 in. from the tygon tubing and terminates in an manual switch connector. The connector fastens to the fuel basins splash guard under the bridgecrane rail. K Basins has had poor experience with gland nut type water tight sealing systems.

High radiation fields in the air will cause Tygon tubing to brown and become brittle. This does not happen in the fuel basins where tygon is placed over the cable and secured by the terminating manual switch connectors. Tygon tubing shall be avoided for pressure applications, but cord-reinformed nylabraid Tygon tubing can be used in applications that are less than 200 lb/in.^{2} and 200 °F. Experience shows that the hose clamp attaching the nylabraid will come off before the tubing yields.

4.2.5 Transducers

- Standard nonradiation-resistant linear voltage differential transformers are used in fuel basins.

- Optical light-sensitive encoders are not used in radiation areas where radiation dose rates are greater than or equal to 2 mrem/hr because they fail quickly. Mechanical displacement encoders are also recommended for underwater applications.

- Syncro-resolver encoders are reliable in radiation environments but they often fail in high humidity environments because of resolver brush corrosion. Syncro-resolvers can be used in NEMA 4 plus housings. A new type of synchro-resolver is brushless and provides absolute positions over a large range and good hermetic seals. Magnetic coupled resolver (quadrature) elements are preferred.

- Brush type encoders are reliable in radiation environments but are limited in high humidity environments. High usage often results in brush failure.

- Underwater magnetic reed-type switches are reliable as long as the current does not exceed 50 percent of its rating.

- Micro switches shall be tested to 1×10^8 rads.

- Solid-state proximity switches will not withstand radiation fields.

- Magnetic coil-type proximity switches will work in radiation fields.

4.2.6 Electrical Material Limitations

- No heat shrink tubing has been found that can withstand a high radiation environment. Use fiberglass type insulating tubing.
- Most plastics will not withstand a high radiation environment where radiation dose rates are greater than 100 mrem/hr at 30 cm. but less than or equal to 500 rad/hr at 100 cm).
- Natural rubber will not withstand a high radiation environment.
- Nylon will withstand a radiation environment, but it will become brittle with time.
- EPDM and Hypalon have good rad (10^6), gray (10^8) lifetimes.

4.2.7 Electrical Motors

Electrical motors are usually nonradiation resistant and therefore must be replaced remotely. Radiation-resistant motors are usually a special run item. At least two spare motors shall be supplied for each radiation-resistant motor. Motors used in the basins should be placed in air-pressurized housings along with their control electronics and moisture detectors. Small waterproof motors (less than 1/2 HP) have been troublesome, but larger motors with simple control circuits are acceptable. Brushless servo motors are trouble-free in basins under 10 ft of water (i.e., load assembly zones) as long as control circuits are maintained.

4.2.8 Control Systems

The design of electrical/electronic control systems shall meet the following design requirements:

- Circuit designs shall be redundant using hardwire, interlocks, or dual logic operation.
- All critical circuit designs shall be failsafe.
- All control systems shall have a preliminary design review by peer groups and a final design review for functional and nuclear safety operations.
- All systems shall be fully documented with wiring, schematic, as-built drawings, and all vendor data.

- Controller design shall be single loop.
- All controllers will have provisions for local and remote displays.
- All control systems must undergo a complete failure analysis.

4.3 LUBRICANTS

4.3.2 Fuel Basins

Lubricants in the fuel basins must be rigidly controlled to prevent contamination of examination specimens and all other fuel basin equipment. The only lubricants currently approved for fuel basin service are the following three insoluble compounds:

1. Lubricate 630AA mixed with Molykote™ 77
2. Never Seize™ pure nickel lubricant
3. Molykote 77

4.3.3 Large Volume Lubricants

Larger quantities of lubricants, such as contained in a gear box, shall be isolated from loss into clean areas by the use of catch pans having a volume capacity 1.5 times the volume of lubricant available. In certain fuel handling locations such as dry cells, the lubricant may be required to be a material which is not a nuclear moderator.

4.4 COATINGS

Coatings are used on nonstainless components to prevent corrosion and/or ease decontamination. For these purposes, coatings need to be hard, smooth, highly adherent, etc. No truly ideal coatings have yet been found, but epoxy-base primers and glossy top coats are extensively used at K Basins for basic facility protection and equipment protection. K Basins currently uses a general Amercoat epoxy system consisting of Amercoat Number 64 primer and Amercoat Number 66 seal gloss topcoat. Mobil 76 can be applied directly onto old Amercoat without a new primer. All painting is according to manufacturers instructions. There is also a high-buildup version of Number 66 for smoothing rough surfaces and special primers for certain materials.

4.5 MANUFACTURING PROCESSES

4.5.1 Welding and Brazing

All welding and brazing done by Westinghouse Hanford on the Hanford Site is controlled by requirements in the Welding Manual (WHC-CM-6-10) and the Welding Procedure Supporting Document (WHC 1992). These documents outline the responsibilities and requirements to be followed.

In addition to the Westinghouse Hanford welding and brazing guidelines, the requirements of specific fabrication codes such as ANSI/AWS D1.1 Structural Welding Code or other design code drawing requirements shall be followed.

4.5.2 Cleaning

Equipment cleaning must remove loose debris, lubricants, and traces of prohibited materials used during manufacturing. Equipment does not require cleaning to "clean room" or "reactor component" standards. Shot blasting and grit blasting are prohibited on materials used in the basins because of the damage they do to the material surface. Blasting can be done on materials used outside the basins. Wire brushing of stainless steel must be done with stainless steel brushes that have not been used on carbon steel. Grinding must also be done with materials that have not been used on carbon steel. (Transfers of carbon steel from the brush or wheel results in rusting on the stainless steel.)

4.6 TESTING

All equipment must be subjected to testing such that its functioning and reliability can be established before placing it in a contaminated environment. Testing shall verify that all control component replacement, and maintenance features can be operated as intended. Familiarization and training of operator personnel shall also be done before fuel basin installation. Mock-up training is required by the Hanford Site Radiological Control Manual (WHC 1994c) and "Occupational Radiation Protection" (10 CFR 835) for certain complex, first time, or high dose jobs. This "Mock-up" training shall closely resemble the field conditions that are expected to be encountered. Equipment debugging in a contaminated environment is prohibitively difficult and is not compatible with minimum personnel radiation exposure. Load testing must be in accordance with the Hanford Site Hoisting and Rigging Manual (DOE-RL 1993b). Testing results must be retained in an equipment history file. Contact the System 14 cognizant engineer for the cranes and hoists equipment history file (currently W. A. Frier, structural cognizant engineer).

Appropriate K Basins plant personnel need to be involved with acceptance testing from the initial design through final testing. Appropriate K Basins plant personnel also need to offer their experience in the initial design process. A design team approach will shorten the design process and ensure a more usable and functional product.

4.7 RECORDS

The engineering records pertaining to modifications of systems or equipment, which were designed, procured, or built by an outside organization and for which responsibility has not been assumed by K Basins, must be submitted to K Basins and documented appropriately.

The engineering records pertaining to modifications of systems or equipment, which were designed, procured, or built by K Basins and for which K Basins has assumed responsibility, shall be documented by engineering change notices and shall be revised and updated in the drawings.

All records for equipment or system modifications shall be retained in the appropriate history file for that equipment or system.

All records that involve the accountability of spent nuclear fuel shall be complete, accurate, and current.

All records that support activities that involve nuclear safety shall be complete, correct, and readily accessible.

The documentation of Sections 1.3.5 and 1.3.6 does not replace the required approvals and documentation relating to fuel handling, lifting and handling, quality assurance, and quality records.

4.8 EQUIPMENT ACCEPTANCE TURNOVER

To transfer from K Basins Projects or other outside engineering (design) groups to K Basins operations or cognizant groups, a formal method of transfer must be initiated by the design group. Attachment 4 serves as this formal method of transfer and must be completed before equipment transfer. A mutual agreement must be reached between the design and user groups to assure smooth transition of the equipment. To accomplish this, personnel from both groups and an operations representative will ensure that Section 4.8.1 is completed. The transfer/turnover process shall be performed in accordance with this section and (WHC 1995d). To obtain a comprehensive understanding of the practical application of the turnover process and configuration management involved, see the text and flow diagrams contained in K Basins Engineering - K Basins Projects Interface Controls, Internal Memo (Schmidt 1995).

4.8.1 Turn-Over Criteria (Design Group Responsibilities)

- The design group must complete the Completion Checklist, (see Attachment 2). This form will be reviewed by the Technical Review Committee to ensure that all required information has been provided and to determine if further information is necessary. For the information details required by this checklist, see Attachment 3.

- When the user group determines that all areas of the turnover checklist have been completed, the equipment will be accepted for use.

- All fuel handling equipment shall be documented on Attachments 2, 6, and 7. These completed forms shall be filed with K Basins Operations.

5.0 DESIGN GUIDELINES FOR SYSTEMS OUTSIDE THE BASIN STRUCTURES

5.1 WATER TREATMENT AND CHEMICAL HANDLING

The water treatment system consists of a water treatment facility and chemical handling systems. The purpose of the water treatment facility and chemical handling systems is to provide water adequate for makeup water to 105 KE and KW Basins, fire protection services, and human consumption. A water quality laboratory monitors the condition of raw and potable water. Requirements for water treatment and monitoring are documented in WAC 246-290-200, "Group A Public Water Systems" (WAC 1994).

Major modifications shall be prepared under the direction and signature of a licensed professional engineer in Washington. Compliance with the design standards in WAC 246-290-200 is mandatory. Approval of the water purveyor is required for all modifications, and of the State Department of Health for major modifications.

5.1.1 K Basins Systems Capabilities and Parameters

Equipment must be designed to be installed and operated by facility services that already exist except in unusual circumstances.

The alum, chlorine, and separan systems are capable of treating the maximum throughput of raw water (32,000 gal/min). However, the water treatment plant is limited to 30,000 gal/min based on existing filter capacity according to WAC 246-290-654.

The facility characteristics which are most likely to affect equipment design, are listed below.

5.1.2 Alarm Settings

Chlorine analyzers currently have alarm setpoints at 1 and 3 parts per million. The low alarm is a flashing red beacon; the high alarm signal is a vibratory alarm and flashing red beacon. The design basis for the setpoints is contained in 1 & 3 Chlorine Analyzer Set Points (WHC 1995a).

5.1.3 Chemical Handling Systems

For most generally applicable system drawings, refer to Interim Essential and Support Drawing List for K Basins (WHC 1994d). All chemicals used for water treatment purposes shall meet American Water Works Association (AWWA) specifications where applicable.

- Alum: H-1-80047 Rev. 0 (WHC 1994a)
- Chlorine: H-1-80048 Rev. 0 (WHC 1994b)
- Separan: H-1-80046 Rev. 0 (WHC 1993)
- 4 more in progress (NEW)

5.1.4 Materials

- Acceptable and Prohibited Materials. It is necessary to control materials that may contact the chemical handling systems. Chlorine has had compatibility problems with galvanized and carbon steel materials.

- Chlorine. Galvanized and carbon steel have compatibility problems with chlorinated solutions used for water treatment, for example, there has been a structural failure of piping components in the chorine system caused by corrosion. Schedule 80 PVC shall be used for all piping and components within the chlorine system to control corrosion.

5.1.5 Mechanical and Electrical

- Acceptable Components. This section provides information on components that are acceptable in water treatment and chemical handling systems.

  - Piping. PVC Schedule 80 can be used on all chemical handling system repairs.

- Lubricants. Lubricants in the water treatment system must be American Water Works Association or National Sanitation Foundation 61 approved to prevent contamination of potable water.

Table 5-1. Water Treatment and Chemical Handling System (Drawing List).

Water Treatment/Chemical Handling System					
Number	Sheet	Rev	Type	Title	Building No.
H-1-80048[1]	1	1	E	Separan Chemical Feed System P&ID	183KE
H-1-80047[2]	1	1	E	Alum Chemical Feed System P&ID	183KE
H-1-80046[3]	1	1	E	Chlorination System P&ID	183KE
H-1-NEW	1	New	E	Separan Control System[4]	183KE
H-1-NEW	2	New	E	Alum Control System[5]	183KE
H-1-NEW	2	New	E	Chlorination Control System[6]	183KE
H-1-NEW	1	New	E	183 Lab Instr., Elec. and Flow Diagram	183KE
H-1-NEW	1	New	E	Sandfilter Flow and Backwash P&ID	183 & 190KE

Notes:

E signifies Essential Drawing
[1](WHC 1994b)
[2](WHC 1994a)
[3](WHC 1993)
[4]Control theory for transfer pump, mixer, injection pumps, and magnetic flow meter.
[5]Control theory for recirculation pumps, magnetic flow meter, and storage tank heating elements.
[6]Control theory for injection pump and ventilation fan.

Table 5-2. Technical Procedures.

No.	Procedure Number	Title
1	59-09-3-1	Mix Separan in Separan Mixing Tank 183 KE
2	59-09-5-2	Operate 183-KE Chlorination System
3	59-23-7-3	183-KE Filter Backwashing
4	59-23-7-1	Operate 183-KE Water Plant (Selected Portions)
5	59-23-6-1	Add Non Chlorinated Water to Number 5 Holding Basin

Table 5-3. Maintenance Procedures.

No.	Procedure Number	Title
1	7-GN-145	PM for Hach Hardness Analyzer
2	7-GN-146	PM Hach Alkalinity Analyzer
3	7-GN-143	PM Hach Chlorine Analyzer
4	7-GN-144	PM Hach Turbidimeter

Table 5-4. Surveillance and Inspection Procedures.

No.	SSP Number	Title
1	E09-001	Maintenance & Functional Test of Left Chorine Analyzer 183KE Chlorine Room
2	E09-002	Maintenance & Functional Test of Right Chorine Analyzer- 183KE Chlorine Room
3	E09-003	Maintenance & Functional Test Chorine Analyzer-183KE Basement
4	E09-005	Chlorination System Leak Testing, 183KE
5	E09-006	Inspection of Chlorine Exhaust Fan, 183KE
6	E09-007	Calibration of Chlorine Weight Indicators 1 & 2, 183KE
7	E09-008	Calibration of Chlorine Weight Indicators 3 & 4, 183KE
8	E23-002	Calibration and Functional Check of pH System, 183KE
9	E43-005	Calibration of Hach Model 18900 Ratio Turbidimeter, 183KE

Table 5-5. Vendor Information Files

No.	CVI File Number	Title
1	4589	Filter Plant
2	12240	Water Quality Lab Instrumentation
3	18512	Interscan Chlorine Analyzers
4	18510	Chlorine gas feeders
5	NEW	Alum & Separan Flowmeters

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6.0 ENVIRONMENTAL, SAFETY, AND QUALITY

Work activities at K Basins are regulated by a combination of federal and state laws and DOE orders. They are implemented through Westinghouse programs, procedures and facility-specific procedures. As a nuclear fuel storage facility, K Basins has specific rules, which are imposed on work performed in the basins, including fuel monitoring and fuel movement. A large part of the regulations are facility-specific (i.e., Standards/Requirements Identification Documents) not project specific. For this reason integration between project engineers and facility personnel (Standards and Requirements) is very important.

An Environmental Impact Statement describing the scope and impacts of projects is being generated, and categorical exclusions have been transmitted to DOE-RL. The Environmental Impact Statement will provide boundaries in which activities can and cannot be performed. A technical support document (WHC 1995c), which is being prepared to help the Pacific Northwest Laboratory write the Environmental Impact Statement, will help scope and plan upcoming projects.

Other environmental restrictions include those set forth by the Environmental Protection Agency and Washington Department of Health's authorization of activities based on their potential emissions and the engineered controls which will be used to limit those potential emissions. All environmental documentation shall be time phased and integrated into the project schedule with a tie to an established and accepted activity. The Environmental Compliance Officer must review and signoff on new material introduced into the basins. Environmental requirements are connected to all projects. Workers must consider all environmental, safety, health, and quality assurance requirements and refer to the Standards Requirements Identification Document (WHC 1995h) to ensure compliance.

All facility modifications require a review, approval designator, and unreviewed safety question screening/evaluation. There must be conducted in accordance with MRP 5.12 (WHC-CM-1-3) and K Basin Administrative Procedure 4-001 (WHC 1994e). Safety analysis and safety assessments shall be conducted in accordance with the Safety Analyses Manual (WHC-CM-3-10). Hazard categories must be identified. Projects shall be assessed for a hazard category following Hazard Categorization And Accident Analysis Techniques For Compliance With DOE Order 5480.23, Nuclear Safety Analysis Reports (DOE 1992) as soon as the process or work is defined in sufficient detail. Other aspects of safety will be addressed and documented in conjunction with the design process. Section 5.0 Nuclear Safety, section 12.0 Fire Protection, and section 19.0 Occupational Safety and Health, of the K Basins S/RID document (WHC 1995h), illustrate all safety issues and requirements applicable to the K Basins. All nuclear, occupational, fire protection and other aspects of the safety assessment will be documented so the stage is set for other activities which may have to be factored into the project schedule.

Work activities at K Basins are also restricted as described in the Implementation Plan to DOE's QA Rule (WHC 1995i). The resolution of "Nuclear Safety Management; Contractor and Subcontractor Activities" (10 CFR 830) criteria 2, 5, 6, and 9 requires some compensatory measures until corrective actions have been completed to satisfy the following quality assurance requirements.

- Hazard category 3 and above activities must pass the Westinghouse Hanford readiness determination process according to the Startup and Restart of Nuclear Facilities (DOE 1993) before being allowed to be performed.

- Work on all K Basins facility safety systems are being controlled through the Westinghouse Hanford Company Job Control System and extensive management oversight. These processes assure that the work is properly planned and executed, and applicable requirements are met.

There are additional quality assurance requirements to validate for characterization and data collection activities used for interim and final disposal of the irradiated fuel and most likely sludge.

7.0 CONTROL DOCUMENTS

All organizations involved with facility modifications and/or fuel equipment design must be familiar with control documentation.

7.1 TECHNICAL DOCUMENTS

The Standards/Requirements Identification Document, (WHC 1995h) is an assimilation of all applicable requirements K Basins must comply.

The Safety Analysis Report for N Reactor Irradiated Fuel, (WHC 1994g) houses requirements concerning facility safety and activities.

The Operational Safety Requirements, (WHC 1993a) list the requirements from the Safety Analysis Report.

The K Basins Process Standards (WHC 1995e) are standards that implement the requirements of the Operational Safety Requirements.

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8.0 LABOR LAWS

The Davis Bacon Law determines whether work assignments are for the Westinghouse Hanford union or for ICF-KH construction. The assignment of work is the responsibility of DOE-RL based upon input on the Davis-Bacon form. The turndown of work is reviewed and coordinated by the K Basins maintenance manager. Turndown of work is required when subcontractors are assigned do the work instead of the Westinghouse Hanford union. This occurs when the Davis-Bacon review determines work is not the responsibility of the union.

Loaning craft resources and initiating turndown work is described in WHC-CM-1-3. MRP 4.7 has recently been rewritten by K Basin maintenance organization to illustrate the loaning craft resources and turndown work processes.

Project (SNF) engineers shall prepare the Plant Forces Work Review (PFWR) early in the design process. Once prepared, the review shall be routed through the K Basins Field Engineering PFWR coordinator. This process will ensure labor decisions are made early.

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9.0 REFERENCES

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ATTACHMENT 1

K BASIN PLANT PROJECT REVIEW PROCESS

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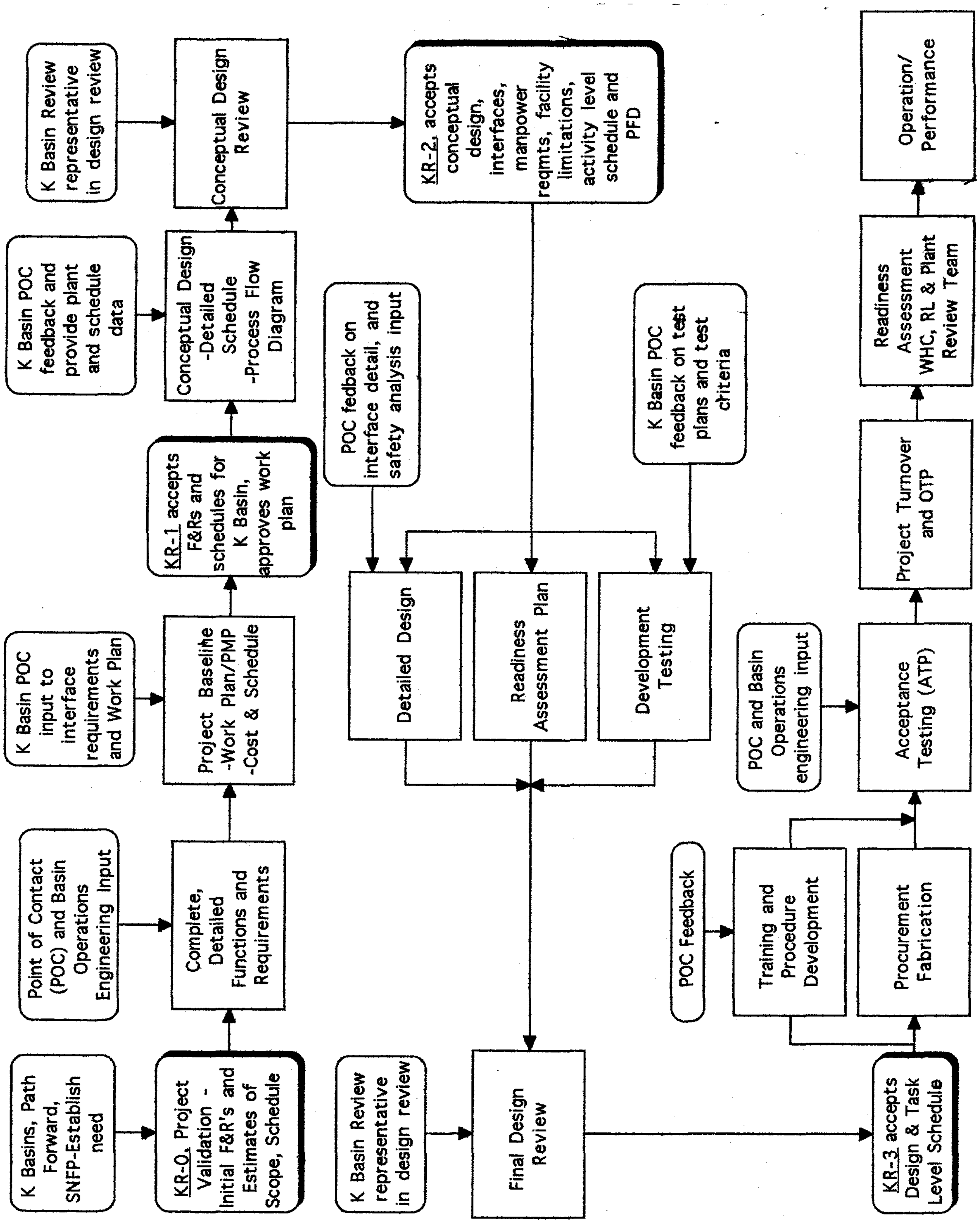
Attachment 1. K Basin Plant Project Review Process.



Attachment 1, K Basin Plant Project Review Process

Flow Diagram Corresponds with *K Basins Plant Review Guidelines*, (WHC-AP-7-001)

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ATTACHMENT 2

K BASINS EQUIPMENT COMPLETION AND FACILITY MODIFICATION CHECKLIST

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ATTACHMENT 2

K BASINS EQUIPMENT COMPLETION AND FACILITY MODIFICATION CHECKLIST

1. Equipment Name ______________________________________

2. Identification Number(s)______________________________________

3. Design Engineer(s)______________________________________

4. Design Objectives______________________________________
____

Functional Requirements______________________________________

5. Equipment Drawings

	TITLE	NO.	REV. =
1)	___________	___________	___________
2)	___________	___________	___________
3)	___________	___________	___________
4)	___________	___________	___________
5)	___________	___________	___________

6. Spare Parts List

1) Parts identified, list attached Yes___
2) Items Placed in Spares System Yes___

7. Equipment Files

Equipment Specification No.______________
Cost Estimates Yes___
Purchase Orders Yes___
Installation Information Yes___

8. Safety Analysis Report Yes___ N/A___
If Yes, Reference Number_______
1. Stress Analysis Yes___ N/A___
2. Failure Mode Analysis Yes___ N/A___

9. Design Report Yes___ N/A___
   1. Special Material Requirements Specified Yes___ N/A___
   2. Drawings Reviewed for Tolerances and manufacturability Yes___ N/A___
   3. Design review conducted Yes___ N/A___

10. Dimensional Inspection of Load Bearing and Critical Parts Yes___ N/A___

11. Equipment Photos Yes___
    List Numbers____

12. Technical Procedure (Operational & Maintenance) Yes___
    Cite Westinghouse Hanford Procedure Number__________

13. Criticality Control Approval
    Is this equipment Nuclear Fuel Handling Equipment Yes___ No___
    If "Yes" cite the Criticality Safety Evaluation

14. Tooling

15. Testing Requirements

    1. Load Testing Yes___ N/A___
       (a) Visual Inspection Yes___ N/A___
       (b) NDT Inspection Yes___ N/A___
       (c) Load Test Yes___ N/A___
       (d) Proof Test Yes___ N/A___

    List Documentation____________________________

    2. Functional Testing Yes___ N/A___

16. Design Documentation

    1. Computer Documentation Yes___ N/A___

    2. Other design documentation Yes___ N/A___
       List where documented______________________

17. Training Documents Yes___ N/A___

Initial Training Route Card No.__________

Qualification Standard Nos.____________

18. Checklist is complete for all items applicable to this equipment and open items have been listed.

Design Engineer______________________Date_______

Design Manager______________________ Date______

K Basins Staff Manager___________________ Date______

29. Equipment Turnover

All drawings and other documentation has been reviewed and is up to date with respect to the as built design, current technical procedure, current equipment history. (To be completed at time of equipment transfer to a different user group).

User Group__________________________Date______

User Group Manager____________________ Date______

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ATTACHMENT 3

K BASINS PRELIMINARY EQUIPMENT DESIGN EVALUATION

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ATTACHMENT 3

PRELIMINARY BASIN EQUIPMENT DESIGN EVALUATION

I. DESCRIPTION OF THE DESIGN FUNCTION OF THE EQUIPMENT:

II. DESIRED AND/OR REQUIRED NUCLEAR SAFETY FEATURES TO PROTECT AGAINST THE FOLLOWING ACCIDENTS ARE DEFINED IN THE "ACCIDENT DEFINITIONS SECTION" OF THIS ATTACHMENT:

A. Overbatching

Generally, K Basins does not have to be concerned with the overbatching accident when handling expended reactor fuel. This accident can be dismissed unless the equipment is designed to handle powders, slurries, or chips.

B. Overloading

Can two or more fuel components be placed in the equipment at the same time? Does the equipment provide features to protect against an overloading accident?

2X fuels can tolerate one overloading accident.

C. Loss of Moderation

Will the equipment unmoderate the fuel or cause a loss of moderator in certain regions of the fuel causing preferential moderation.

Generally, the loss of moderation does not cause a reactivity increase.

D. Increase in Moderation

Will the equipment cause the fuel to be moderated with any materials besides water?

E. Increase in Reflection

Will the equipment be made of materials with densities higher than stainless steel? Will the equipment provide gamma radiation shielding, e.g., lead, concrete, depleted or natural uranium? If so, the configuration of the fuel and shielding must be analyzed for neutron reflection.

G. Loss of Normal Geometry

Will the equipment crush, drop, cut, or mill the fuel under normal operating or accident conditions?

H. Loss of Isolation

Will the equipment provide devices or fixtures to provide protection against an overloading accident? If so, can the devices be removed or compromised during normal operating or accident conditions?

Will the equipment provide locations for multiple fuel components with isolation between components? If so, can the isolation between the fuel components be lost under normal operating or accident conditions?

ACCIDENT DEFINITIONS

Overbatching

Overbatching is the act of adding more than the manufacturing tolerance of U-235 (or other fissile material) to a fuel component (up to twice the specified fuel loading).

Overloading

Overloading is the act of placing more than one limit of fuel in a criticality control zone.

Loss of Moderation

Loss of moderation is the act of losing the nominal moderator in some areas near the fuel causing a reactivity increase.

Increase in Moderation

Increase in moderation is the act of adding a moderator, which is not a nominal condition, causing a reactivity increase.

Increase in Reflection

Increase in reflection is the act of introducing a reflector near the fuel which causes an unplanned increase in reactivity.

Loss of Geometry

Loss of geometry is the act of physically altering the dimensions which results in an increase in reactivity.

Loss of Isolation

The loss of isolation accident can be separated into three accidents: loss of crit-zone isolation, loss of crit domain isolation, or loss of surveillance.

The loss of crit-zone isolation is the act of losing isolation between crit-zones. This accident can happen, for example, by the accidental removal of a fuel basin gate in the fuel basins. Or this accident can result from environmental accidents such as a severe earthquake, tornado, etc. The result of the loss of a crit-zone isolation can produce the same result as an overloading accident.

The loss of crit domain isolation is the act of losing a factor of two barrier. For example, if the original barrier is two feet, when the barrier is reduced to one foot, crit isolation domain is lost. This accident does not result in a reactivity increase, but it results in a loss of one level of protection against an overloading accident.

The loss of surveillance is nearly identical to the loss of crit domain isolation, and the results of this accident is the same as for the loss of crit domain isolation.

Both the loss of crit domain isolation and loss of surveillance accidents can be classified as a loss of (2X) a factor of two controls.

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ATTACHMENT 4

K BASINS EQUIPMENT DOCUMENTATION

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ATTACHMENT 4

K BASINS EQUIPMENT DOCUMENTATION

Cognizant Engineers are responsible for keeping a current equipment list for a particular system. Each cognizant engineer is responsible for the equipment in his/her system. Cognizant engineers and their corresponding systems can be identified through K Basins organizational managers. A comprehensive 100 K Area equipment list does not exist at this time.

REQUIREMENT: Prior to introducing a new piece of equipment or a system into operation at K Basins, the following documentation must be completed and approved.

DEFINITION: The Completion Checklist and associated documentation is a report that provides an INDEX OF TRACEABILITY for a system from its inception through its design, fabrication, installation, and testing. Information required during use; such as required training, spare part identification, and recommended maintenance is also to be included. It is recommended that this documentation be initiated early in the equipment evolution in order to provide a guide to describing the complete system for use and record. It must be completed prior to placing equipment in operation regardless of when it was initiated.

REPORT CONTENTS: The following items, highlighted in the Completion Checklist, are presented in detail below. If a line item is not applicable, state the reason, not just N/A.

1.0 SUMMARY

1.1 Write a brief (five to six words) name which summarizes the equipment's primary function and does not duplicate a similar system or tool name.

1.2 Write a concise paragraph describing the system or hardware.

2.0 DESCRIPTION

Information here is intended to provide the engineer, who will assume final ownership of the equipment, some insight and background into the thought process that went into the development of the equipment. This is an attempt to document the sort of information that would otherwise be lost because it is not typically requested nor routinely provided in conjunction with any other equipment documentation. This information shall, as a minimum, include:

1. A detailed listing of all the design criteria that had to be met by the device. Provide information on the sources of all design constraints and requirements.

2. A complete explanation of the rationale that went into the selection of the final design concept and what specific advantages or disadvantages it possess over other design concepts that were considered but not developed.

3. A complete explanation as to how the designed equipment meets all of the design requirements and constraints.

4. Describe what compromises from the optimum were made in the design and development of the equipment. Explain why these compromises had to be made.

5. A section for documenting lessons learned during the process of equipment design and development. Describe all significant pitfalls and problems areas that were encountered; provide input as to how they were, or might have been, averted. Based upon what was learned during the entire process of equipment design and development, describe in sufficient detail, what changes should be made if either the identical, or similar, piece of equipment were to be developed again.

3.0 DESIGN

3.1 Equipment specification number and revision or equivalent description or requirements.

3.2 Correspondence letters, numbers, and dates that detail design reviews and reconciliation of review comments.

3.3 Design analyses and acceptance (location and identification) including criticality control analyses, approvals associated with fuel handling equipment, and reconciliation of design review comments.

3.4 Acceptance Testing (performed to comply with Appendix M (WHC 1994b) and in accordance with the June 13 (Schmidt 1995) Internal Memo).

3.5 Design approvals (letter numbers and dates only).

3.6 Approved Safety Analyses Report citing the letter number of the report and the Westinghouse Hanford approval letter.

3.7 List of Technical Work Record books used (engineer's, and location of archived records).

3.8 List of the persons and organizations responsible for the design and other stages of the program.

3.9 Functional requirements and justification matrices from the original proposals.

3.10 Applicability to other programs and/or disposition information.

3.11 Highlight any special prohibitions, restrictions, or controls required (materials, cleanliness, etc.).

3.12 Design features to aid in disposal, list where assumptions were made and features developed.

4.0 FABRICATION

4.1 Identity of all fabrication purchase order(s) including a list of all change notices.

4.2 Location of significant vendor certifications covering the manufacture and testing by the vendor.

4.3 Location of significant records such as critical installation dimensions, weld history, and radiography documents.

4.4 Identification of Quality Assurance requirements.

4.5 Identification of vendor test packages.

4.6 Identification and explanation of any deviations from design caused by changes made during installation.

5.0 TESTING

5.1 Test specification number(s) and revision. (Vendor's and K Basins).

5.2 Summary of test results for fabricated component testing.

5.3 An analysis of testing and a statement as to the useability as proven by the testing.

5.4 Identify load test work packages. If vendor fabricated parts are identified for load test, include the vendor load test certification(s). Determine and identify the load test periods as established in gef-76.

6.0 INSTALLATION

6.1 Identify the review and mockup testing performed to ensure the adequacy of the new design prior to installation in a radiological environment.

6.2 Specific location in K Basins (column number, etc.).

6.3 Installation procedure, subcontract, and JCS numbers, must be used to prepare, fabricate, and install.

6.4 List of drawings (list in an appendix if the list is long). The list shall provide the drawings title, number, and revision for all mechanical and electrical drawings (including changes per 8.7.3). Include support system(s) and tooling drawings.

6.5 Location of drawings and availability (including upgraded facility drawings).

6.6 Identification numbers. This shall include capital equipment property tag numbers for all the capital equipment items in the system, and shall include instructions for making the equipment assembly number on the equipment in a prominent location.

6.7 Critical dimensions and requirements required for installation such as power, water, and air requirements, control system interfaces, power panel shutoff, and any limits on accessibility.

6.8 A manufacturer's manual describes the equipment and the operation, maintenance, and repair.

7.0 FISCAL SUMMARY

7.1 Cost estimate history including engineer notes and references.

7.2 Final costs of all fabrication and installation purchase orders and route cards.

7.3 Budget identification (Cap E, GPP, MCP, or M&O).

8.0 PROCEDURES

8.1 TECHNICAL PROCEDURES (IDENTIFICATION)

This procedure shall contain all information needed for personnel to operate the equipment under all anticipated modes of use. Also included shall be any and all precautions and warnings associated with equipment operation. The information provided will be incorporated into an official K Basins Operations Procedure by the procedure development organization at K Basins.

This procedure shall identify operating instructions for all phases of technician interface. Details are presented in 100-K Area Operations Procedures Administration (WHC 1994a) and Engineering Practices Guidelines (WHC 1994b), Appendix J.

This procedure shall list operations for all preventative maintenance and frequencies. Troubleshooting charts shall be included. Other periodic evaluations including calibrations and required testing shall be included. Procedures for performance of surveillance, calibration, testing or preventative maintenance of installed plant equipment shall be developed in accordance with (WHC-CM-5-13).

8.2 RADIOLOGICAL CONTROL REQUIREMENTS

Identification of special Radiological Controls (RAD CON) requirements, including handling and disposing of generated waste.

8.3 COMPUTER EQUIPMENT REQUIREMENTS

8.3.1 Identify each item of the computer system by name, model number, and serial number.

8.3.2 Program information including subroutines, flow charts, logic diagrams, ladder logic, and revision numbers, author, computer operating systems, language, revision history, medis type, development platform, testing, and location of a hard copy of the program(s).

8.3.3 Location and name of remotely stored backup disk.

8.4 TRAINING REQUIREMENTS

8.4.1 System training JCS/procedures.

8.4.2 Qualification standards including frequency of examination for the complete system and all phases of its operation.

8.5 Recommended Spares List

8.5.1 List of parts which are consumed by use and wear. If item is off-the-shelf, identify brand, part number, and/or approved equal. List parts by name and drawing number. This includes mechanical parts which contain friction surfaces subject to wear; e.g., bearings, bushings, leadscrew, ball nuts, etc., as well as any assembly or part that will deteriorate with frequent remote assembly or handling. Electronic spares include all electronics and wiring exposed to radiation, as well as other electronics and semiconductors that can fail due to heat buildup.

8.5.2 Availability - The designer is responsible for the ordering and stocking of the required spare parts.

8.6 Tools Required to Support K Basins "Path Forward"

All tools and equipment are to be identified with the number(s) of the H-1 drawing that were used for their design and construction. The drawing number(s) must be permanently stamped or engraved upon the device at location that is readily visible once the equipment is situated in the facility. If at all possible, the drawing identification number shall appear on a portion of the tool or equipment that remains above the basin water and near to the location where the equipment is to be operated by personnel.

The drawing number's digits must be sized as appropriate for the equipment. If the device is to be located entirely underwater, the drawing number must be made large enough, and positioned such that, it would be visible to an observer standing on the working level of the basin looking at the equipment through the water. Instead of being engraved or stamped, the number on underwater equipment can be painted on in numerals of black or a contrasting color.

8.7 HAZARDOUS MATERIALS CONSIDERATIONS

8.7.1 Identify of material of concern.

8.7.2 Protective clothing requirements.

8.7.3 Recommended disposal methods.

8.7.4 MSDS into file(s).

8.8 END-OF-LIFE DISPOSITION

List design features that are included to aid in disposal (surface finish, module Array, etc.) and what assumptions were made in designing disposal features. Explain whether hollow structural members are sealed or drilled through for drainage. If drilled through, show where drain holes or plugs are located. Explain or identify Non-hazardous Material Certification. Consult sections 20 and 16 of (1995h) to ensure compliance with environmental and waste management requirements.

9.0 OPEN ITEMS

List items that have not been completed as of the review date for this document. Provide a sufficiently detailed description of each open item so that the user can understand any restrictions imposed by that open item. State the expected completion date and the group responsible for completion.

10.0 APPENDICES

Items with extensive lists, detail, data, vendor documents, and instructions that require further explanation as determined by the author or user, shall be included. These appendices shall be indexed and cross referenced back to the appropriate item in the report section.

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ATTACHMENT 5

MATERIAL PIPE CODE - BASIN WATER SYSTEM

ATTACHMENT 5
MATERIAL PIPE CODE - BASIN WATER SYSTEM
Design Code - ASME B31.1

Sizes	≤ 1½	2 in. - 24 in.
Pipe Material[1]	Carbon Steel - ASTM A106 Gr B	Carbon Steel - ASTM A106 Gr B or ASTM A53 Gr B Seamless
Wall Thickness	Sch 40	Sch 40 - except ≥ 12 in. is .375 in. wall
Unions[1]	300 lb. malleable iron, screwed, brass seat, per ANSI B16.3	Not allowed - use flanges
Fittings[1]	300 lb. malleable iron, screwed, per ANSI B16.3	Wrought Steel conforming to ASTM A234 Gr WPB, Buttweld ends, dimensioned per ANSI B16.9.
Flanges[1]	None	150 lb, weldneck*, Carbon Steel conforming to ASTM A105 and ANSI B16.5. Raised Face except where connecting to flat faced flanges. * where connecting to existing lines, slip-on-welded flanges may be used. Note: Use of flanges shall be limited to connecting to valves, specialties and pumps.
Bolts[1]	None	ASTM A307 Gr B ASTM A193 Gr B7[1,2] 1. Do Not Use on Cast Iron Flanges 2. Do not mix grades
Nuts[1]	None	ASTM A563 Gr D Heavy Hex ASTM A194 Gr 2H Heavy Hex
Gaskets	None	Nonasbestos ⅛ in. thick, Garlock style 3000 Flexitallic style CG Neoprene, 50 -80 Durometer Flat Faced flanges shall have full face gaskets.

ATTACHMENT 5
MATERIAL PIPE CODE - BASIN WATER SYSTEM
Design Code - ASME B31.1

Sizes	≤ 1½	2 in. - 24 in.
Instrument Tubing	.035 wall Ss, or equal SST ASTM A213/A269 Tp 304	None
Gate Valves[1]	Crane Co 431UB Nibco Fig T-134 Jenkins Fig 41-U Lunkenheimer Fig 3151 Stockham Fig B-120 Walworth Fig 11 Powell Fig 514	Crane Fig 465½ Nibco Fig F-617-O Stockham Fig G-623 Walworth Fig 8726-F
Globe Valves[1]	Crane Fig 7 Nibco Fig T-235 Jenkins Fig 106-A Lunkenhiemer Fig 123 Stockham Fig B-22T Walworth Fig 3095 Powell Fig 150	Crane Fig 351 Nibco Fig F-718-B Stockham Fig G-512 Walworth Fig 8906-F
Check Valves[1]	Crane Fig 36 Nibco Fig T-473-B Jenkins Fig 762-A Lunkenhiemer Fig 554-Y Stockham Fig B-345 Walworth Fig 3420 Powell Fig 560	Crane Fig 373 Nibco Fig F-918-B Stockham Fig G-931 Walworth Fig 8928-F
Ball Valves[1]	Nibco T-595-Y McCanna M202-BR-T-BR Jamesbury	McCanna S151-CS-T-S6-Lockable Jamesbury 5150-1-22-36-UU
Instrument Needle Valves[1]	Hoke 3700-3800 Series Parker CPI V Series Whitey Brass Body Valves	None

[1]Use of stainless steel is not prohibited.

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ATTACHMENT 6

K BASIN FUEL HANDLING EQUIPMENT REVIEW AND APPROVAL

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ATTACHMENT 6

K BASIN FUEL HANDLING EQUIPMENT REVIEW AND APPROVAL

1.0 APPROVED FUEL HANDLING EQUIPMENT

Equipment used for shipment, transfer processing, or storage of nuclear fuel shall be designed, constructed, maintained, and used such that fuel handling operations in which it is used satisfy the K Basins Nuclear Fuel Requirements. The equipment will be reviewed and approved by a Westinghouse Hanford Criticality Safety Representative. A written record shall be kept indicating the associated safety analysis, the Environmental Compliance Officer (ECO) approval, location of the equipment, approval date, and any restrictions. The forms needing documentation are the Photo Log Sheet, and the Completion Checklist (Attachments 7, and 2). Before fuel handling equipment can be used at K Basins it must have the above approvals. This is primarily an aid to the fuel handler.

Note: The potential for radiation streaming through hollow tools shall be considered during the design phase of any equipment used in the K basins. Hollow tools must be filled with water.

1.1 TYPES OF EQUIPMENT USED IN K BASINS FUEL HANDLING OPERATIONS

Table A6-1 lists the categories of fuel handling equipment by groups.

1.2 CRITERIA FOR APPROVAL OF EQUIPMENT

Fuel handling equipment is designed to be part of a fuel handling process with an associated Criticality Safety Evaluation Report. This safety evaluation identifies elements of Nuclear Safety which the equipment design must satisfy. The elements of Nuclear Safety are identified by considering how each of the eight generic accident types (overbatching, overloading, loss of moderation, increase in moderation, increase in reflection, loss of poison, loss of normal geometry, and loss of isolation), described in Attachment 3, applies to the specific piece of equipment. The K Basins facility is considered a low criticality risk facility. The equipment approval process by Westinghouse Hanford Criticality Safety Representative for a low criticality risk facility is summarized below:

1.3 EQUIPMENT REQUIRING EXPLICIT APPROVAL OF WESTINGHOUSE HANFORD COMPANY CRITICALITY SAFETY REPRESENTATIVE

1.3.1 Obligations of the Sponsoring Organization

The K Basins group sponsoring a new or significantly changed fuel handling operation shall request criticality control review of the fuel handling operation and items of equipment to be used. This will be done prior to initiating the operation.

1.3.2 Westinghouse Hanford Criticality Review

Proposals for new equipment or modifications to existing equipment are discussed with the facility Criticality Safety Representative (CSR). The CSR considers the proposal and determines if it is within the bounds of existing criticality safety analyses. If so, any modifications the CSR deems necessary to existing Criticality Prevention Specifications (CPS) are prepared and the design work may proceed. If any changes are made during this process the CSR must be informed. Should the proposal not fall within the existing analyses, the CSR will determine if a revision or entirely new criticality safety evaluation will be needed. The evaluation (usually prepared, for K Basins, by Nuclear Analysis and Characterization) is documented in a Criticality Safety Analysis Report (CSER), issued as a Westinghouse Hanford Supporting Document (SD). New or revised CPS requirements are derived from the CSER. Both the CSER and the CPS are approved by Criticality and Consequence Analysis (CCA) and Spent Nuclear Fuel Safety as well as K Basins Operations, Technical Safety, and Quality Assurance. Westinghouse Hanford Criticality Safety Representative shall review the items of equipment required for operation; in the context of the operation, and inform the initiating group.

2.0 FUEL STORAGE RACK REQUIREMENTS

2.0.1 Underwater Storage

Underwater storage racks are described in the K Basins SAR (WHC 1994g)

2.1 Special Equipment for Providing Nuclear Isolation

Nuclear isolation is provided by the storage racks and canisters, which are described in the SAR (WHC1994g), Addendum 2 (Safety Equipment List).

2.1.1 Criticality Safety Features

Generally 12 in. water isolation is considered to provide neutronic isolation for basin storage. This is a nominal value. An empty storage rack in all directions, or a concrete basin wall, is considered equivalent to one foot of water for isolation purposes. The shortest dimensions of a storage rack space is actually about 10 in.

Table A6-1. Fuel Handling Equipment Approval Requirements.

Equipment		Design, Construction, Maintenance and Use	Approval Requirements
Group 1: Requires WHC Nuclear Safety (Criticality) Approval For item or type or Type			
1.1	Fuel Storage Devices & associated hardware	Nuclear Safety Requirements	WHC Safety Analysis Report
1.2	Storage Racks and Canisters	Nuclear Safety Requirements	WHC Safety Analysis Report
1.3	Multiple Canister Overpacks (MCO), Shipping Casks	Nuclear Safety Requirements	WHC Safety Analysis Report
Group 2: Approved Based on Other Defined Standards			
2.1	Cranes and Lifting Equipment	DOE-RL-92-36 Hoisting & Rigging Manual	K Basins Cog Eng. IS&H, & K Basins Operations
2.2	OFF-Site Fuel Shipping Casks & Inserts	DOT Shipping Requirements	DOT Approval
2.3	ON-Site Fuel Shipping Casks	(WHC 1995b)	DOE-RL Approval
2.3	Fuel Elevators	WHC Lifting Standards	Maintain WHC Lifting Standard Requirements
2.4	Test Assembly Pressure Vessel	SNF Pressure Vessel Code	WHC QA Inspection
Group 3: Approval Based on General Criteria			
3.1	Small Tools & Similar Equipment (probe poles, hand tools, etc.)	Work Area Operating Practices	Approved Work Area & Fuel Handling Procedures
3.2	Dimensional Measuring Devices	Work Area Operating Practices	Approved Work Area & Fuel Handling Procedures

Table A6-1. Fuel Handling Equipment Approval Requirements.

Equipment		Design, Construction, Maintenance and Use	Approval Requirements
3.3	Ultrasonic & Gamma Spectrum Measuring Devices	Work Area Operating Practices	Approved Work Area & Fuel Handling Procedures

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ATTACHMENT 7

K BASINS APPROVED HANDLING EQUIPMENT PHOTO LOG SHEET

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ATTACHMENT 7

K BASINS APPROVED HANDLING EQUIPMENT PHOTO LOG SHEET

C.C. No.___

Requisitioner Name:______________________Submittal Date:___________________

Item Name:____

Where Used:____

(XXX)______________Drawing No.__________Dimension:_____________________

Comments:____

____

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ATTACHMENT 8

DESIGN PROCESS FOR FACILITY UPGRADES AND NEW PROCESS

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ATTACHMENT 8

DESIGN PROCESS FOR FACILITY UPGRADES AND NEW PROCESS

1.0 PRELIMINARY DESIGN/JOB SCOPE

1.1 IDENTIFY NEED (MANAGEMENT)

1.2 ESTABLISH FUNCTIONAL REQUIREMENTS (KNOW THE RULES/REQUIREMENTS)

1.2.1 Design Criteria

1.2.2 Location of Use

1.2.3 Operational Considerations

1.2.4 Radiological Requirements

1.2.5 Nuclear Safety Requirements

1.2.6 Level III Schedule

1.2.7 ALARA Considerations

1.3 IDENTIFY PROPOSED FUNDING METHOD

1.4 PUBLISH FUNCTIONAL REQUIREMENTS (INTERNAL)

2.0 CONCEPTUAL DESIGN

2.1 INVESTIGATE ALTERNATE SOLUTIONS

2.2 DEVELOP LIKELY CONCEPTUAL DESIGN(S)

2.2.1 Conceptual Drawings

2.2.2 Target Costs

2.2.3 Facility Impact

2.2.4 Satisfy Functional Requirements

2.2.5 Level IV Schedule

2.2.6 Hazard Classification

2.2.7 Safety Assessment

2.2.8 ALARA Considerations and Radiological Issues

2.3 CONCEPTUAL DESIGN REVIEW(S)

2.4 UPDATE FUNCTIONAL REQUIREMENTS

2.5 PUBLISH CONCEPTUAL DESIGN REPORT

2.5.1 Describe the Alternates Investigated

2.5.2 Recommended Concept

2.5.3 Target Cost Estimate

2.5.4 Support Information, Stress Calculations, etc.

2.5.5 Sketches/Drawings

2.6 REQUEST FUNDING AS APPROPRIATE

2.7 READINESS ACCEPTANCE PLAN

3.0 DETAILED DESIGN

3.1 ISSUE REQUEST FOR DRAFTING

3.2 DESIGN INDIVIDUAL COMPONENTS

3.2.1 Design Calculations

3.2.2 Detail and Assembly Drawings

3.2.3 Drawing Reviews/Signoffs

3.2.4 Level 5 Schedule

3.3 DESIGN REVIEW(S) EVALUATION

3.3.1 Physical Arrangement

1. Overall size
2. Installation/handling path
3. Transit/installation path
4. Cleanliness
5. Module removability
6. Clearance to adjacent (stationary and moving) equipment
7. Leveling ability
8. Hardware Standardization
9. As-built dimensions and photos
10. Drawing number of assembly visible
11. Features incorporated as a result of operations input

3.3.2 Material Use

1. Corrosion resistance (rust check proven)
2. Radiation resistance
3. Material limitations
4. Material applications
5. Identify material limits for spares

3.3.3 Interfaces

1. Electrical
2. Plant air
3. Instrumentation
4. TV and lights
5. Operational access
6. Use of special tools
7. Visibility from operator position
8. Protective devices
9. Fuel handling equipment list

3.3.4 K Basins Specific Requirements

3.3.5 Assumptions

1. List significant assumptions
2. Identify justification
3. Specifically address the review of the assumptions and their justification
4. Identify the method of verifying computer models
5. Formal Design Review

3.4 FINAL COST ESTIMATE

3.5 PUBLISH DESIGN REPORT

3.5.1 Functional Requirements

3.5.2 Design Criteria and Significant Assumptions

3.5.3 Cost Estimate

3.5.4 Results of Design Reviews

3.5.5 Technical Calculations

3.5.6 System Description

3.5.7 Drawings

3.5.8 Funding Information/Approvals

3.5.9 Supporting Documentation

3.5.10 Technical Specifications

3.5.11 Major Procurement Review Board Review

3.5.12 Evidence of Independent Design Review

3.6 PREPARE READINESS PLAN (90 DAY - 6 MONTH LEAD ITEM)

3.7 SUBMIT TO GOVERNMENT FOR INFORMATION/APPROVAL

4.0 PROCUREMENT

4.1 ISSUE PURCHASE DOCUMENT FOR INQUIRY REQUEST AND THE COMMERCE BUSINESS DAILY PUBLICATION AS REQUIRED BY whc PROCUREMENT

4.2 ISSUE INQUIRY REQUEST TO DOE-RL AS REQUIRED

4.3 ADVERTISE IN COMMERCIAL BUSINESS DAILY AS REQUIRED

4.4 ISSUE REQUEST FOR BIDS

4.5 EVALUATION/RECONCILIATION OF BIDS

4.6 ISSUE REQUEST

4.7 PLACE PURCHASE ORDER

4.8 FABRICATION

4.9 ACCEPTANCE OF PRODUCT (ON-SITE INSPECTION)

4.10 (START) PROCUREMENT OF SPARE PARTS

5.0 RECEIPT PREPARATION

5.1 PREPARE FACILITY INSTALLATION AREA

5.2 WRITE OPERATING PROCEDURE

5.3 WRITE MAINTENANCE SPECIFICATIONS

5.4 ESTABLISH MOCKUP TESTING REQUIREMENTS

6.0 SUPPORT AND STAGING EQUIPMENT AVAILABILITY

6.1 MAJOR COMPONENTS

6.2 AUXILIARY EQUIPMENT REQUIREMENTS

6.3 INTERCONNECTING HARDWARE

6.4 TIE-DOWN MATERIALS

6.5 PAINT

6.6 OPERATING TOOLS

6.7 SPECIAL LIFTING EQUIPMENT

7.0 MOCKUP TESTING

EVALUATE:

7.1 ABILITY TO HANDLE INTENDED TEST SPECIMENS

7.2 ADEQUACY OF FUNCTIONAL TESTS

7.3 TOLERANCE OF DESIGN FOR OPERATIONAL AND MAINTENANCE ABUSE

7.4 ADEQUACY AND VERIFICATION OF VENDOR TESTS

7.5 VISIBILITY FOR OPERATION OF TOOLS

7.6 OPERATION INTERLOCKS

7.7 OPERATOR TRAINING AND QUALIFICATIONS

7.8 PERFORM FINAL "DRESS REHEARSAL" MOCK-UP WITH CONDITIONS, LIMITS, AND RESTRAINTS MATCH WHAT IS EXPECTED IN THE FIELD

8.0 PERFORM READINESS DETERMINATION

9.0 INSTALLATION

9.1 RECEIPT INSPECTION

9.2 CLEAN CHECKOUT/MOCKUP

9.3 TRAIN TECHNICIANS

9.4 FINALIZE PROCEDURES

9.5 ADD TOOL TO APPROVED LIST OF FUEL HANDLING EQUIPMENT (IF APPROPRIATE)

9.6 PHOTOGRAPH OF EQUIPMENT

9.7 INSTALL EQUIPMENT

10.0 PREPARE FINAL DESIGN REPORT

10.1 PROCUREMENT INFORMATION

10.2 AS-BUILD DRAWINGS (ENSURE DRAWING CHANGES HAVE BEEN INCORPORATED INTO IN-HOUSE DRAWINGS)

10.3 CALCULATIONS

10.4 OPERATING PROCEDURE

10.5 PREVENTIVE MAINTENANCE PROCEDURE

10.6 SUPPORTING DOCUMENTATION

10.7 PHOTOGRAPHS

10.8 DOCUMENT SPARE PARTS INTO SYSTEM

11.0 ACCEPTANCE DOCUMENTATION

11.1 EQUIPMENT COMPLETION

11.2 FUEL HANDLING EQUIPMENT APPROVAL

ATTACHMENT 9

BASIC DRAWING REQUIREMENTS

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ATTACHMENT 9

BASIC DRAWING REQUIREMENTS

Detailed usable drawings are required to provide the user of K Basins equipment with hardware drawings suitable for repair, maintenance, or modification. The following lists are provided to guide the designer in obtaining suitable drawings from suppliers required to furnish detail and assembly drawings for fabrication. Normally suppliers are not required to provide drawings to the Westinghouse Drawings Standards but commercial drawings standards are used. The usability of the drawing after fabrication requires that drawing describe, as a minimum, the following basic requirements.

1.0 DETAIL DRAWINGS

Basic: Shows sufficient detail to fabricate part.

1.1 DIMENSIONAL INFORMATION

1.2 MATERIAL IDENTITY

1.3 FABRICATION DETAIL (E.G., WELDING SYMBOLS)

1.4 FABRICATION PROCEDURE CALLOUT

1.5 TOLERANCES AND GEOMETRIC CONTROL

2.0 ASSEMBLY/SUBASSEMBLY DRAWINGS

Basic: Provides views to show interrelation of parts and lists the additional hardware or procedures for assembly necessary to provide the COMPLETE assembly.

2.1 A PARTS LIST (BILL OF MATERIAL)

2.1.1 Part Name

2.1.2 Number of Parts Required Per Item

2.1.3 Drawing Number of Part or Sufficient Detail to Allow Ordering of Commercial Hardware

2.2 Views Showing Interrelation of Parts

2.3 Fabrication Detail Required for Assembly

2.4 Overall Dimensions of the Assembly

2.5 Special Materials or Procedure That Complete the Assembly (e.g., Oil Required in Gear Reducer or a Unique Test Procedure)

2.6 It is Preferred, But Not a Requirement, To Show

2.6.1 Weight

2.6.2 Center of Gravity of Complex Assemblies or Building Detail

2.6.3 Adjacent Existing Equipment or Building Detail

2.6.4 Next Higher Assembly or Subassembly

3.0 RECORD DRAWINGS

Basic: To provide a permanent record of vendor information for Westinghouse use and files.

3.1 Reproducible Copies of All Drawings

3.1.1 CAD Files

3.1.2 Brownlines are Acceptable If a Readable Copy Can Be Made

3.2 Three Black and White Copies, of All Drawings, Suitable for Microfilming

3.3 Good copy or original of all vendor procedures that are not available from commercial sources or would require resubmittal if obtained from another supplier.

3.4 A Drawing List showing all of the drawings, procedures and information in the items transmitted in the submittal. This list shall include the revisions of the drawings transmitted.

3.6 CADD Data, If Available

4.0 AS-BUILT DRAWINGS

Basic: To provide actual dimensions, locations, or identity of component for later reference.

4.1 Usually as-built drawings are marked on copies of the final drawings and are in addition to manufacturing dimensions. Any other scheme shall be defined.

4.2 When as-built dimensions are requested to describe dimensions that have NOT been limited by previous drawings, e.g., a final pipe run location, the as-built features are described on the final drawings the same as other required dimensions.

4.3 Critical dimensions, for installation of additional equipment or as references for periodic inspections, are often requested from the supplier as part of final inspection.

5.0 SCHEMATIC DIAGRAMS/FLOW DIAGRAMS

Schematic diagrams/flow diagrams including vendor supplied circuits will be provided with all equipment.