

ARH-LD-155
Informal Report

STANDARDS, METHODS, AND PROCEDURES
FOR DRILLING AND SAMPLING DRY WELLS

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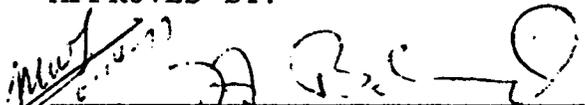
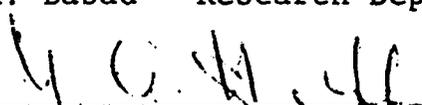
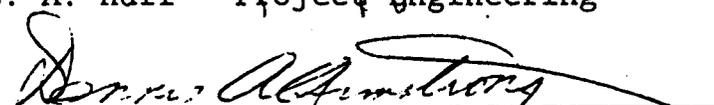
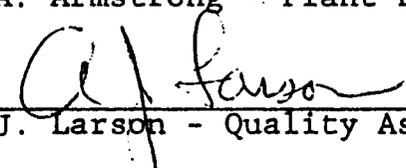
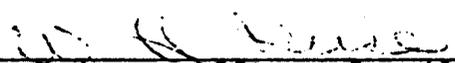
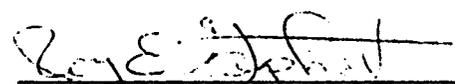
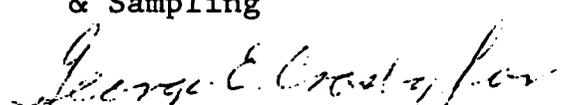


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STANDARDS, METHODS, AND PROCEDURES
FOR DRILLING AND SAMPLING DRY WELLS

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STANDARDS FOR ALL DRY WELL STRUCTURES

The standards for all dry well structures are summarized below.

1. The location of all dry wells in the 200 Areas control zone shall be established within measurement capability with reference to the Hanford coordinate system. The accuracy to which the coordinates are established shall be the same for all dry wells.
2. A facilities change notice shall be processed to show the exact location of each new dry well on as built drawings.
3. All dry wells shall be permanently marked giving the well number according to the Hanford numbering system.
4. The elevation of all dry wells shall be established with reference to the nearest first-order bench mark. A mark designating the elevation point on the top of the casing shall be affixed for reference.
5. The diameter of the casing used in dry wells shall be no less than four inches (inner diameter), and shall permit a 20-foot section of 3.5-inch (inner diameter) casing to easily pass to the bottom of the well.
6. The ground surface around the dry wells shall be sufficiently stabilized (grouted) to prevent the ground from caving in and surface waters from infiltrating into the ground next to the casing.
7. Each well shall be covered to prevent any foreign material from entering the well.
8. Wells shall be grouted following construction to assure that no annular space exists between the casing and the adjacent sediments.
9. Monitoring wells in tank farms should not exceed a depth of 125 feet.

10. As a minimum, new well design shall conform to State of Washington standards.⁽¹⁾ (Copies of these standards are available from the Office of Drilling and Sampling.)
11. Notice is to be given to the Office of Drilling and Sampling prior to any new well construction or repair of existing wells.
12. The bottom of all wells with an interval not cased shall be sealed against the surrounding sediments by inserting a cement plug through the uncased interval.
13. No monitoring wells in tank farms shall be perforated (unless there is a need for perforating to grout the well).
14. All wells shall have sediment samples collected at a minimum frequency of every five feet during drilling. The samples shall be stored in the Hanford well library.
15. Water or mud shall not be used when drilling in tank farms.
16. Standard Operating Procedures (on file with the Office of Drilling and Sampling) pertaining to well drilling and sampling shall be reviewed prior to initiation of each drilling contract.

PROCEDURE FOR THE DRILLING OF NEW DRY WELLS

When new dry wells are planned, the following is required.

1. Determine the coordinates at which the well is to be drilled.
2. Prepare drilling and sampling specifications.
3. Notify the Office of Drilling and Sampling.
4. Prepare an excavation permit and obtain a well number from ARHCO Plant Engineering.

⁽¹⁾ State of Washington Department of Ecology, "Minimum Standards For Construction And Maintenance Of Water Wells," Chapter 173-160 WAC., Adopted April 30, 1973, Effective May 30, 1973 and Water Well Construction Act (1971), Chapter 18.104 RCW.

5. Prepare a facility change notice.
6. Write and let contract.
7. Survey and stake well location.

SELECTION OF DRILLING METHOD

The method selected for drilling a well will be determined by:

- the purpose of the well;
- contamination level expected, if any, when drilling in a zone of possible contamination; and
- time restraints upon finishing well.

Atlantic Richfield Hanford Company, Research Department, will offer assistance in the selection of the most advantageous drilling technique.

Well drilling specifications should be designed so that a reasonably representative geologic sample can be obtained at specified intervals. For example, an air rotary drill rig can collect more representative samples than a cable tool drill rig using a bit and bailer. A cable tool drill rig, using a core barrel, can collect more representative samples than an air rotary drill rig.

MINIMUM STANDARDS

Wells shall be drilled 20 feet with casing one size larger than that to be used for the remainder of the well. Insert the size casing needed into the 20-foot deep hole and continue drilling and driving the casing downward until the well is five feet below the desired depth. Pour cement into the well until the desired depth is reached. Add cement to the annular space between the well casings while concurrently removing the outer well casing⁽²⁾ (see Figure 1).

⁽²⁾ D. L. Isakson and R. C. Tabasinske, Atlantic Richfield Hanford Company Specification HWS-8803, Revision 2, "Specifications and Conditions for Drilling Radiological Test Wells," Atlantic Richfield Hanford Company, Richland, Washington, October 14, 1975.

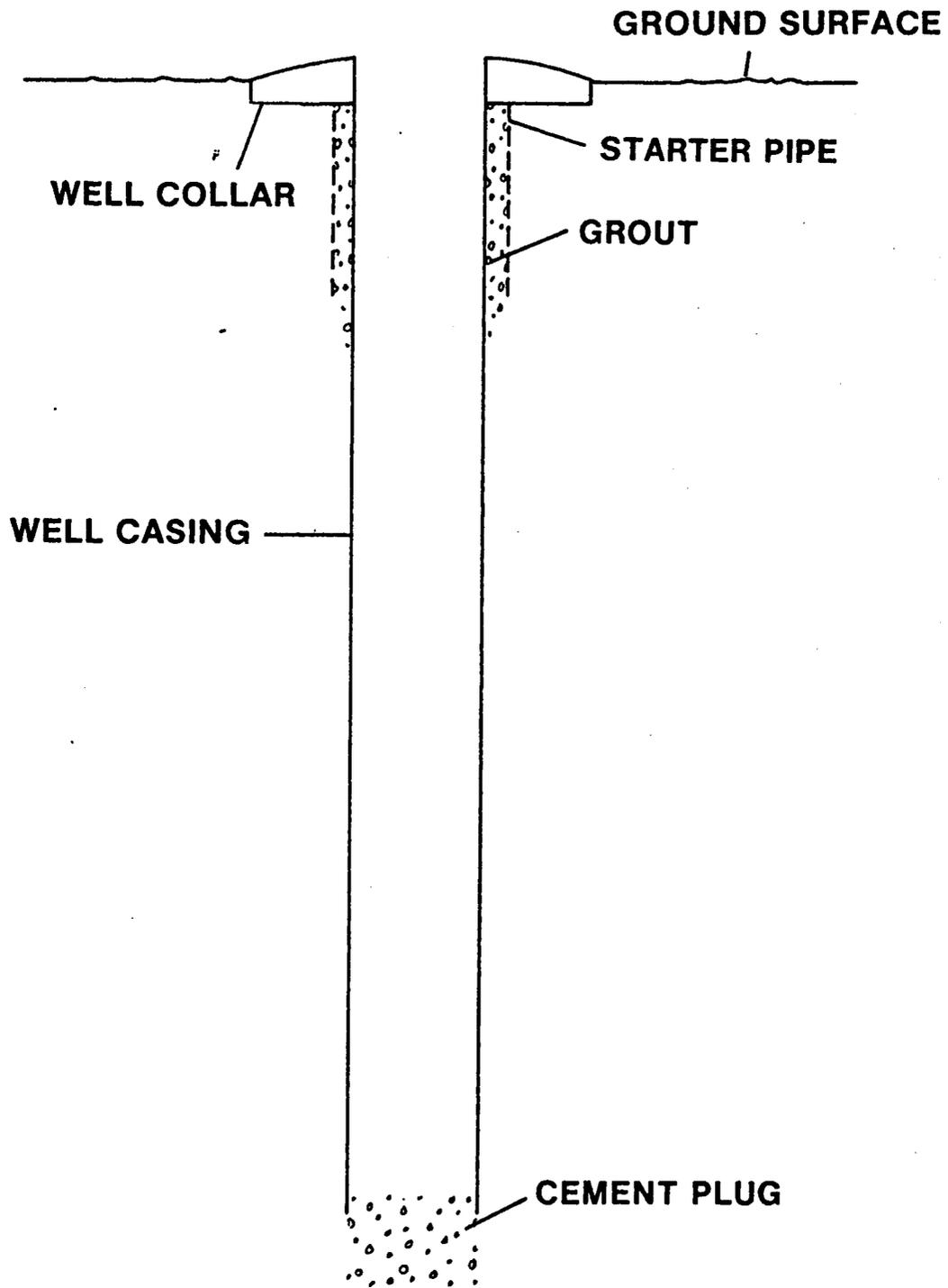


FIGURE 1

SECTION VIEW OF NEW WELL

WELLS TO BE REMOVED AFTER USE

Wells may be drilled without a cement collar if the well casing is to be immediately removed after completion.

Where well casings are removed, the holes shall be filled with cement as the casing is concurrently pulled.

MINIMUM GUIDELINES FOR SAMPLING CONTAMINATED SEDIMENTS

In some wells, contaminated sediments may be encountered. Samples of the contaminated sediments should be collected for analysis. These analyses aid in fingerprinting the source of contamination, the distance the contamination has moved from its source, and aid in inventorying the amount of radionuclides released into the subsurface environment. All sampling of contaminated sediments shall be in accordance with ARH-220(3) and the Research Department Standard Operating Procedures.

FREQUENCY

A sediment sample should be collected as soon as contamination is encountered. Additional samples should be collected at a minimum of five-foot intervals below the ground surface or whenever a change in lithology is observed, whichever comes first.

COLLECTION

The method used to collect the radioactive samples can affect the final analytical results.

The following guidelines shall be used for sampling of contaminated sediments.

1. The casing shall be driven and the well cleaned out in the standard manner (see HWS-8803, Revision 2).⁽⁴⁾

⁽³⁾ "Radiation Protection Standards and Controls," ARH-220, Atlantic Richfield Hanford Company, Richland, Washington, July 1976.

⁽⁴⁾ Ibid., p. 4.

2. The sample shall be taken from the inside portion out of the bottom of the core barrel.
3. Samples with greater than 10,000 counts per minute beta (in the core barrel) shall be placed in a 25-cubic-centimeter plastic vial and the vial filled flush with the top.
4. Samples with less than 10,000 cpm beta (in the core barrel) shall be placed in a 500-cubic-centimeter polyethylene bottle and the bottle filled to the neck.
5. Samples reading greater than 500 disintegrations per minute alpha shall be placed in a 500-cubic-centimeter polyethylene bottle and the bottle shall be filled to the top.

All samples shall be collected in duplicate and immediately marked as to the well number, location of sampling point, and radiation reading. Appropriate radiation stickers shall be affixed to the sample containers.

SHIPMENT OF SAMPLES

Shipment of all radioactive samples shall be in compliance with ERDA Manual Chapter 0529⁽⁵⁾ and the Research Department Standard Operating Procedures.⁽⁶⁾

An Onsite Radioactive Shipment Record (Form 54-6000-079) shall be prepared as well as the analysis sheet requesting type of analysis (Form A-6700-100). The dispatcher shall then be notified for pick up of the samples. Samples shall be delivered by the dispatcher to the 222-S Building. The dispatcher shall contact the Chemical Technology Laboratories Subsection when the samples arrive.

Upon completion of the analyses, copies of the data shall be sent to the Manager, Tank Farm Surveillance, and the tank farm and actinide trench geologists.

⁽⁵⁾ E. F. Curren, "Atlantic Richfield Hanford Company Radioactive Material Shipping Manual," ARH-MA-101 REV, Atlantic Richfield Hanford Company, Richland, Washington, February 1976.

⁽⁶⁾ Compiled by G. W. Cramer, "Research Department Standard Operating Procedures, Atlantic Richfield Hanford Company, Richland, Washington, September 1976.

GUIDELINES FOR SAMPLING UNCONTAMINATED SEDIMENTS

The collection of sediment samples from wells provides a permanent record of the sediment types under the Hanford Reservation. These sediment samples are analyzed for size, mineralogy, sorption properties and hydrologic properties to aid in predicting rates and direction of radionuclide migration. Sediments from all wells drilled on the Hanford Reservation will be catalogued at the Hanford Well Library located in Igloos T-105 and T-106, west of the 200 West Area.

FREQUENCY

Samples should be collected at each five-foot interval from the ground surface and at each change in lithology, whichever comes first.

COLLECTION

The following guides shall be used.

1. Samples shall be collected using a standard drive barrel or split tube sampler.
2. The casing shall be driven to the bottom of the hole and the hole cleaned out to the level of the casing shoe.
3. The drive barrel shall be driven so as to penetrate at least one foot below the casing shoe into undisturbed sediments.
4. One-quart samples typical of the material being penetrated shall be taken and placed in two or more clean one-pint jars.
5. The jars shall be plainly labeled (using Form BD-6000-106) showing the well number, the depth which the sample was taken, the drilling method, and any other pertinent information.

SHIPMENT OF SAMPLES

After the well is complete, the samples shall be surveyed by Radiation Monitoring and delivered by the driller to the

-S Building loading dock or to the nearest geologic
 pling storage building located outside the 200 East and
 West Area Tank Farms.

Technical geologist shall pick up samples from the loading
 dock and the geologic storage buildings and enter them into
 Hanford Well Library.

DAILY HOLE DRILLING LOG

INFORMATION

drilling contractor shall maintain a continuous, chrono-
 logical drilling log for each well on drilling log forms (A-
 O-021). The minimum information to be recorded shall be
 follows.

The depth of the hole from the ground surface; thickness
 of each significant sedimentary rock type; (rock type
 shall be defined as percent silt, percent coarse,
 medium, and fine sand, percent pebbles, percent cobbles,
 etc.); general character (color, sorting, etc.); and
 drilling characteristics (hard to drill, flows into
 well, etc.) of each lithology er

The depth and thickness of each

The direction of air circulatio
 of the hole.

The time and duration of all s
 iods, with the reasons therefc

A record of all difficulties encou
 operations.

Depth at which each sample is taken.

The radiation monitoring readings on each sample.

Method of drilling used, core-barrel (C), hard tool
 (H), or rotary (R).

Size of casing in hole and amount in hole below ground
 surface at end of each shift.

*Missing
 Sample
 Point*

METHOD OF KEEPING THE LOG

The log shall be kept complete, legible and accurate with entries made in sequence so that each can be correlated with the depth of the hole at the time. It shall be complete at the end of each drilling day and shall be available to ARHCO upon call at any time during the work. If a standby or shutdown period results from any order by ARHCO, such an order shall be noted on the driller's original record and shall be initialed by ARHCO. A complete, legible copy of the log signed by the driller, shall be furnished daily to the Research Department.

PROPOSED ACTIONS

MONITORING WELLS WHICH ARE PERFORATED

Certain existing dry wells in tank farms are in poor condition and require repairs (Table I). Specific repairs needed to bring these wells in line with the standards discussed on pages 2 and 3 are as follows.

The dry wells should be fully perforated (see Figure 2) two cuts per round and one round per foot from the bottom of the casing up to a point 70 feet below the ground surface and perforated from 20 feet to the top of the casing. Four and one-half inch casing, with a bottom plug, should be run into the existing casing. The four and one-half inch casing should then be welded to the existing casing and the annular space filled with grout.

A-FARM MONITORING WELLS

Due to the startup of the 242-A Evaporator Crystallizer, and the increased usage of the 241-A Tank Farm system, there is a need to deepen the existing 75-foot dry wells in 241-A Tank Farm to a depth of 125 feet and to upgrade these dry wells to the standards and criteria set up in this document.

OTHER WELLS TO BE DEEPEMED

Some tank farm monitoring wells have radioactivity at their bottoms (see Table II). These wells will be deepened in

TABLE I

PERFORATED WELLS IN THE 200 AREAS TANK FARMS

<u>Tank Farm</u>	<u>Well Number</u>	<u>Computer Number</u>	<u>Drill Depth (Feet)</u>	<u>Diameter (Inches)</u>	<u>Perforations (Feet)</u>	<u>Perforation Schedule (Cuts Per Foot)</u>
B	E33-51	20-00-02	150	10	49-149	6
	E33-52	20-00-05	153	10	52-152	"
	E33-53	20-00-01	152	10	50-149	"
	E33-54	20-08-02	150	10	50-150	"
	E33-55	20-00-11	159	10	50-150	"
	E33-56	20-00-07	150	10	48-148	"
	E33-57	20-00-09	150	10	49-149	"
BX	E33-61	21-27-11	150	8	40-100	5
	E33-62	21-00-05	150	8	"	"
	E33-63	21-00-01	150	8	"	"
	E33-64	21-08-02	150	8	"	"
	E33-65	21-00-11	150	8	"	"
	E33-77	21-00-07	150	8	"	"
	E33-78	21-00-21	150	8	"	"
BY	E33-83	22-00-05	150	8	40-100	5
	E33-84	22-00-03	150	8	"	"
	E33-85	22-00-01	150	8	"	"
	E33-86	22-06-07	150	8	"	"
	E33-87	22-08-07	150	8	"	"
	E33-88	22-00-10	150	8	"	"

TABLE I (Continued)

<u>Tank Farm</u>	<u>Well Number</u>	<u>Computer Number</u>	<u>Drill Depth (Feet)</u>	<u>Diameter (Inches)</u>	<u>Perforations (Feet)</u>	<u>Perforation Schedule (Cuts Per Foot)</u>
C	E27-51	30-08-03	150	8	48-148	5
	E27-52	30-00-12	150	8	50-148	"
	E27-53	30-00-10	150	8	48-148	"
	E27-54	30-00-03	155	8	54-154	"
	E27-55	30-00-06	154	8	53-153	"
	E27-56	30-00-01	145	8	43-143	"
	E27-57	30-00-09	151	8	51-151	"
	S	W23-51	40-00-02	150	6	40-100
W23-52		40-02-04	150	6	"	"
W23-53		40-03-05	150	6	"	"
W23-54		40-05-05	150	6	"	"
W23-55		40-06-05	150	6	"	"
W23-56		40-00-06	150	6	"	"
W23-57		40-09-05	150	6	"	"
SX		W23-58	41-06-11	101	6	10-99
	W23-59	51-02-07	101	8	"	"
	W23-60	41-01-07	101	8	"	"
	W23-61	41-00-02	102	8	"	"
	W23-62	41-04-07	101	8	"	"
	T	W10-52	50-00-08	150	6	50-150
W10-53		50-00-12	151	6	"	"
W10-54		50-00-10	150	6	"	"
W10-55		50-00-06	150	6	"	"
W11-51A		50-00-03	148	6	"	"
W11-53A		50-00-05	150	6	"	"

TABLE I (Continued)

<u>Tank Farm</u>	<u>Well Number</u>	<u>Computer Number</u>	<u>Drill Depth (Feet)</u>	<u>Diameter (Inches)</u>	<u>Perforations (Feet)</u>	<u>Perforation Schedule (Cuts Per Foot)</u>
TX	W15-67	51-00-03	150	8	38-98	5
	W15-68	51-17-03	150	8	40-100	"
	W15-69	51-00-06	150	8	40-100	"
	W15-70	51-00-05	150	8	40-100	"
	W15-71	51-03-02	150	8	60-100	"
	W15-72	51-11-02	150	8	40-95	"
	W15-73	51-00-07	150	8	40-100	"
	W15-74	51-00-09	150	8	40-100	"
	W15-75	51-00-10	150	8	40-100	"
	TY	W10-82	52-04-10	150	6	40-100
W10-83		52-04-03	150	6	40-100	"
W15-79		52-06-05	150	8	40-100	5
U	W18-51	60-00-06	151	10	48-148	6
	W18-52	60-00-11	150	10	"	"
	W18-53	60-00-10	150	10	"	"
	W18-54	60-08-10	160	10	"	"
	W18-55	60-00-08	150	10	"	"
	W19-53A	60-00-05	148	10	46-146	"
	W19-54A	60-00-02	153	10	51-151	"

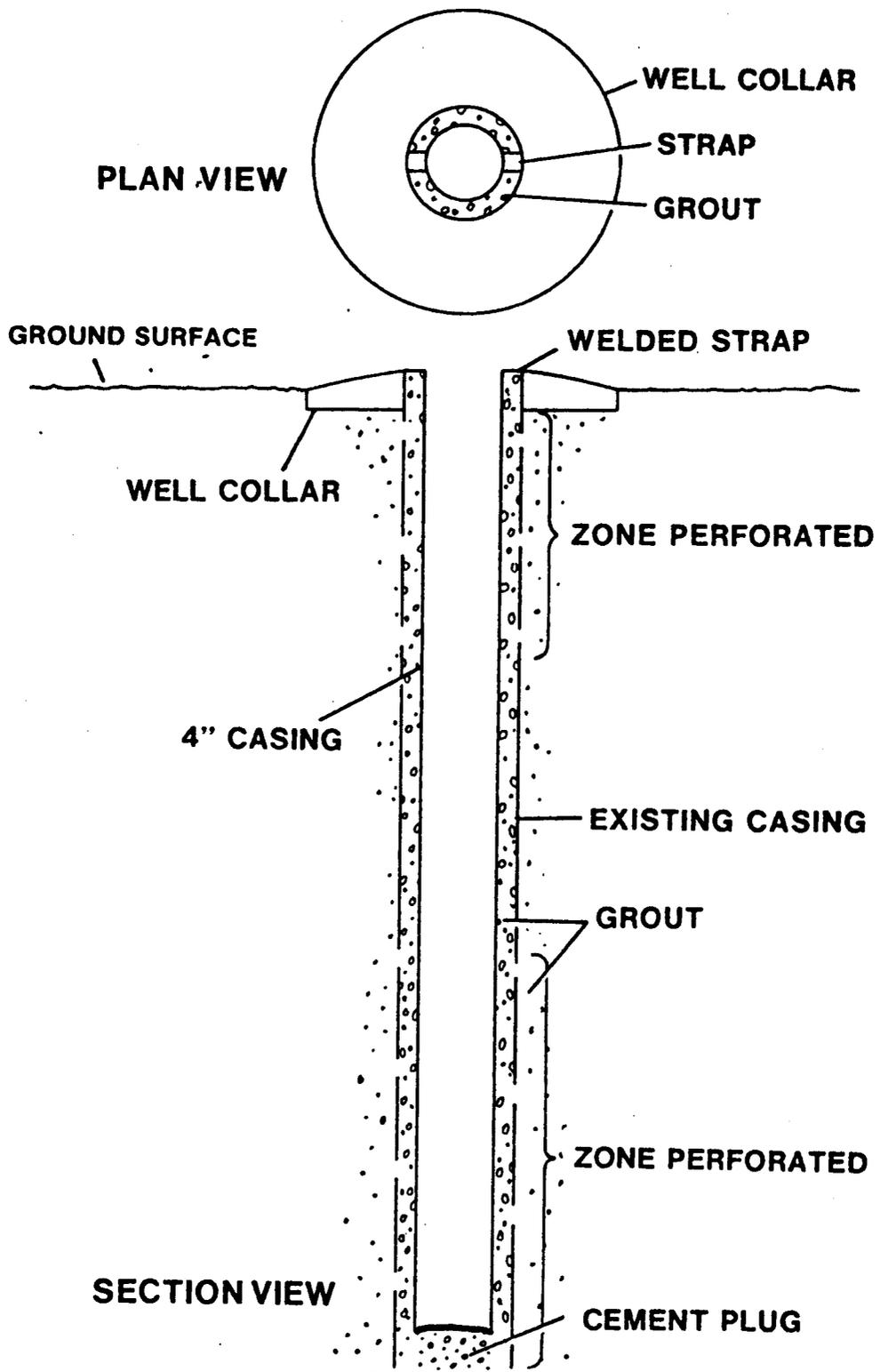


FIGURE 2

PLAN AND SECTION VIEW OF PERFORATED DRY WELL

TABLE II

WELLS TO BE DEEPEINED
(EXCLUDING 241-A TANK FARM WELLS)

<u>Tank Farm</u>	<u>Well Number</u>	<u>Computer Number</u>	<u>Drill. Depth (Feet)</u>	<u>Diameter (Inches)</u>
AX	E25-128	11-02-12	54	6
	E25-124	11-04-11	100	"
BX	E33-222	21-07-06	"	"
	E33-223	21-10-03	"	"
BY	E33-103	22-03-05	"	"
	E33-248	22-04-07	"	"
	E33-111	22-05-09	"	"
	E33-115	22-07-01	"	"
	E33-206	22-07-02	"	"
	E33-116	22-07-05	"	"
	E33-251	22-07-07	"	"
C	E27-79	30-04-03	"	"
	E27-118	30-05-07	"	"
SX	W23-77	41-07-07	70	"
	W23-100	41-08-07	75	"
	W23-104	41-09-03	75	"
	W23-105	41-09-04	105	"
	W23-107	41-09-07	75	"
	W23-111	41-12-02	125	"

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TABLE II (Continued)

<u>Tank Farm</u>	<u>Well Number</u>	<u>Computer Number</u>	<u>Drill Depth (Feet)</u>	<u>Diameter (Inches)</u>
TY	W10-96 W15-186	52-03-06 52-05-07	100 144	6 6
U	W18-113	60-12-01	125	6

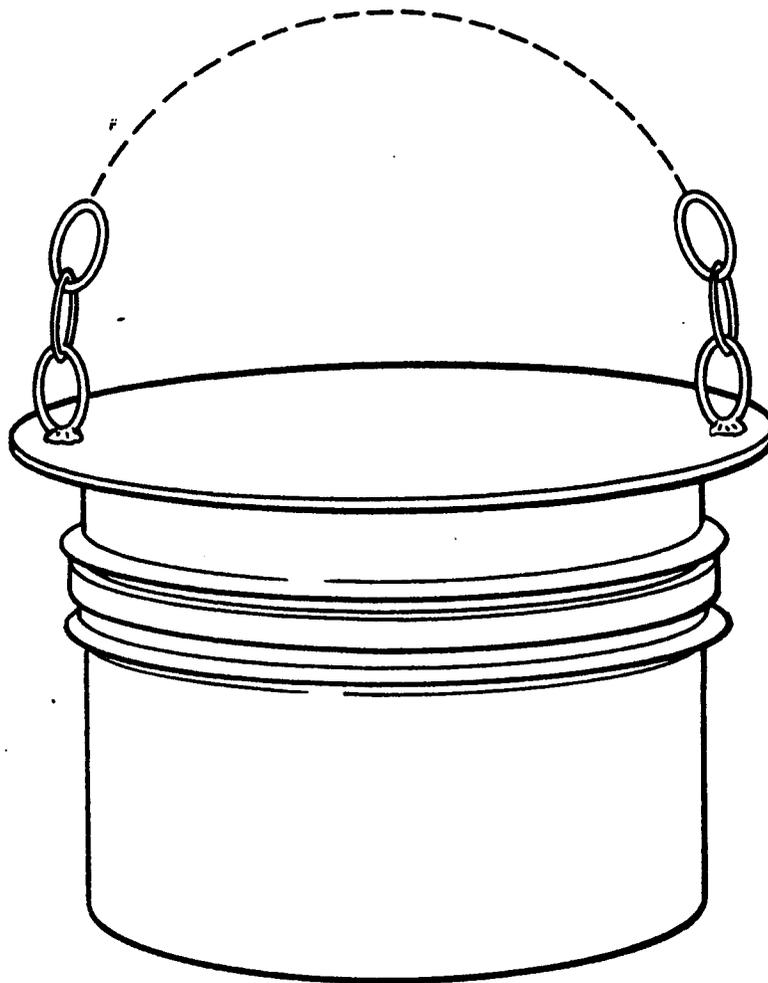
order to better define the extent of activity in the sub-surface.

MONITORING WELL CAPS

Most existing dry well caps are substandard inasmuch as they leave the potential for foreign material to enter the well. A capping device, such as the one shown in Figure 3, will be built and installed on all tank farm dry wells.

STORAGE OF CONTAMINATED SEDIMENT SAMPLES

No facility exists as a permanent repository for storage of contaminated sediment samples. A facility will be designed and built for both alpha contamination and beta gamma contamination.



**5" SCREEN PACKER W/NEOPRENE SEAL 1/4" X 7 3/4" PLATE
WELDED TO TOP OF PACKER 5/0 TRADE SIZE 9" CHAIN**

FIGURE 3
WELL CAP SEAL

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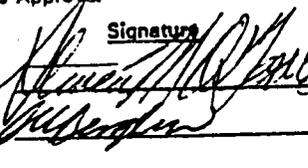
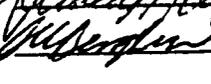
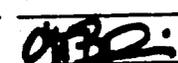
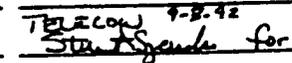
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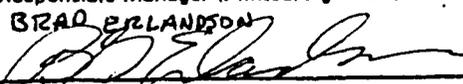
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Title of Conference or Meeting	Group or Society Sponsoring
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Will proceedings be published? <input type="checkbox"/> Yes <input type="checkbox"/> No	
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Title of Journal	

CHECKLIST FOR SIGNATORIES

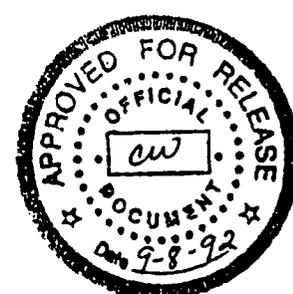
Review Required per WHC-CM-3-4	Yes	No	Reviewer - Signature Indicates Approval
			Name (printed) Signature Date
Classification/Unclassified Controlled Nuclear Information	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>STEVE OTOOLE</u>  <u>9/5/92</u>
Patent-General Counsel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>SW BERLIN</u>  <u>9/8/92</u>
Legal-General Counsel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Applied Technology/Export Controlled Information or International Program	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
WHC Program/Project	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>GREG BOLLN</u>  <u>9-3-92</u>
Communications	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
RL Program/Project	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<u>GENE SENAT</u>  <u>9-3-92</u>
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Other Program/Project	<input type="checkbox"/>	<input type="checkbox"/>	

Information conforms to all applicable requirements. The above information is certified to be correct.

References Available to Intended Audience	Yes	No	
Transmit to DOE-HQ/Office of Scientific and Technical Information	<input type="checkbox"/>	<input type="checkbox"/>	<u>N/A</u>
Author/Requestor (Printed/Signature)			Date
<u>STEVE SENAT</u> 			<u>9-2-92</u>
Intended Audience			
<input type="checkbox"/> Internal <input type="checkbox"/> Sponsor <input checked="" type="checkbox"/> External			
Responsible Manager (Printed/Signature)			Date
<u>BRAD ERLANDSON</u> 			<u>9-3-92</u>

INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP

Stamp is required before release. Release is contingent upon resolution of mandatory comments.



Date Cancelled	Date Disapproved
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This list provides the instructions for each reviewer. It is meant to be used as a checklist and requires no signatures. The list is not all-inclusive but covers the key areas needing review. Areas needing further review or other areas needing review should be indicated under comments.

Author/Requestor

- Project or program manager concurs with the issuance of this report.
- Reference citations are necessary, correct and appropriate for the intended audience and will be publicly available at the time the document is published.
- If a journal article, the reference style agrees with guidance from the client or journal publisher.
- Contributions from authors of other organizations indicated in the comment section of this form.
- Document is responsive to the client's scope of work.
- Client approved this for release.
- Document reports or reflects quality technical work.
- Scientific methodology used is logical and reasonable.
- Inferences and conclusions are soundly based.

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Indicated at the bottom of the comment section of this form that General Counsel's office should review this document with particular attention to:

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- Copyrighted information
- Trademark information
- Proprietary information.

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- Information generation dates
- Prior dissemination to DOE contractors
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Document reviewed for [and indicated on the front of the form] the presence of the following:

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Document reviewed for [and indicated on the front of the form] the presence of the following:

- Previously reported or as yet unreported patentable subject matter
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- This document contains no unresolved company policy issue.
- WHC logotype is used correctly.

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Document reviewed for [and indicated on the front of the form] the presence of the following:

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Information Release Administration

- All reviews are complete and this publication or presentation is approved for release (after resolution of mandatory comments).

ATTACHMENT SHEET
DOCUMENTS REQUESTED BY ECOLOGY INSPECTION OF C-FARM.
AUGUST 26 & 27, 1992

1. WHC Internal Memo to CM Walker from FS Strong. Subject: DRYWELL
30-03-09 DATA REVIEW, 9/18/87.
2. WHC Internal Memo to RK Welty from DR Groth. Subject: ENVIRONMENTAL
PROTECTION DEVIATION REPORT 87-10, RADIATION LEVEL INCREASE IN DRYWELL
30-03-09, 2/22/88.
3. ARH-LD-155 Informal Report for STANDARDS, METHODS, AND PROCEDURES FOR
DRILLING AND SAMPLING DRY WELLS.
4. ECN'S: 171767, 121401, 154781, ~~131828L~~.
5. EO'S: 36922, 40212, 44760, 37763, 08457.
6. DRAWINGS: H2-73338, H2-36835, ~~HW-72184~~, H2-37912, H2-73343, H2-38672,
H2-73876, H2-38599, H2-73973, H2-93620, H2-73349, H2-73350,
H2-99375 1-2, H2-37001, W-71387, H2-82564, *H2-72184, H2-72449*
7. DRAWINGS: H2-92486, H2-72449