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AUTH.NAME AUTHOR AFFILIATION
VAN BRUNT,E.E. Arizona Public Service Co.
RECIP.NAME RECIPIENT AFFILIATION
KNIGHTON,G.W. Licensing Branch 3

SUBJECT: Forwards draft proposed FSAR changes re radwaste sys & effluent streams.Changes will be incorporated in FSAR Amend 14 scheduled for Feb 1985.

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Arizona Public Service Company

ANPP-31414-EEVB/WFQ
December 10, 1984

Director of Nuclear Reactor Regulation
Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
PVNGS FSAR Update - Radwaste Systems and
Effluent Streams
File: 84-056-026; G.1.01.10; 84-019-026

References: (1) Letter from E. E. Van Brunt, Jr., APS, to G. W. Knighton, NRC, dated June 14, 1984 (ANPP-29750), Subject: Monitoring of Gaseous Effluents for Palo Verde.
(2) Letter from E. E. Van Brunt, Jr., APS, to G. W. Knighton, NRC, dated October 17, 1984 (ANPP-30885) Subject: Gaseous Effluents Monitoring

Dear Mr. Knighton:

Enclosed are draft proposed FSAR changes for your information that 1) identifies capabilities to use portable radwaste solidification systems, 2) deletes use of the crud filter subsystem by deleting the backflushable purification filter and 3) clarifies radiation monitoring capabilities and 4) makes minor editorial changes. These changes are considered acceptable as 1) the use of a portable radwaste solidification is permitted by the Technical Specifications, 2) the imposition of 10 CFR 61 required a redesign of purification filtration due to size constraints, and 3) radiation monitor capabilities were enhanced as previously described in References 1 and 2.

These changes are expected to be incorporated in FSAR Amendment 14 to the FSAR which is scheduled for submittal in February 1985. Please contact William Quinn of my staff if you have any questions.

Very truly yours,

E. E. Van Brunt

E. E. Van Brunt, Jr.
APS Vice President
Nuclear Production
ANPP Project Director

EEVB/WFQ/mb
Enclosure

B001
1/1

[illegible]

[illegible]

ANPP-31414

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, Edwin E. Van Brunt, Jr., represent that I am Vice President, Nuclear Production of Arizona Public Service Company, that the foregoing document has been signed by me on behalf of Arizona Public Service Company with full authority to do so, that I have read such document and know its contents, and that to the best of my knowledge and belief, the statements made therein are true.

Edwin E. Van Brunt

Edwin E. Van Brunt, Jr.

Sworn to before me this 10 day of December, 1984.

Nora E. Meador

Notary Public

My Commission Expires:
My Commission Expires April 6, 1987

cc: A. C. Gehr (w/a)
R. P. Zimmerman (w/a)
E. A. Licitra (w/a)

filters and disposable crud filters are related to their corresponding input activities provided in table 11.4-2.

RESPONSE: The following assumptions were utilized in establishing SRS output activities in Table 11.4-6.

1. Evaporator concentrates are solidified and stored in the high activity storage area for one month (i.e., 1 month decay) prior to shipment.

2. Spent resin beads are stored for 6 months prior to solidification. Solidified resin is stored in the high activity storage area for 1 month (i.e., 1 month decay) prior to shipment. 4

3. Cartridge filters are solidified and stored in the high activity storage area for one month (i.e., 1 month decay) prior to shipment.

4. Disposable crud filters are stored for one month (i.e., 1 month decay in the high activity storage area prior to shipment.

QUESTION 11A.12 (NRC No. 460.18) (11.5)

We have reviewed your submittal dated April 6, 1981, relating to TMI Action Plans II.F.1, Attachments 1 and 2, and III.D.1.1 of NUREG 0737. We find your information scant and very inadequate. Please provide the information on these action items as required by NUREG-0737. For guidance, you may refer to submittals on these action plans for other PWRs such as San Onofre, Units 2 and 3, and Summer Nuclear Station, which have been found acceptable by the staff. 6

RESPONSE: Amendment 1 to the PVNGS Lessons Learned Implementation Report (LLIR) was submitted August 3, 1981. It contains an expanded discussion of noble gas monitoring and effluent sampling per Attachments 1 and 2 to NUREG 0737 Item II.F.1.

Topical Report for Radwaste Solidification System (Cement). Instrumentation and control devices provided are shown on figure 11.4-2. The capability is provided to perform on-truck solidification of evaporator bottoms using various sizes of disposable liners if the need should arise. [INSERT A]

11.4.2.3.2 Dry Waste Disposal

Potentially radioactive dry wastes are collected at appropriate locations throughout the plant as dictated by the volume of these wastes generated during operation or maintenance. As necessary, these wastes are taken to the radwaste building for packaging, where they are first compressed in drums to minimize shipping volume. Additional compressible material is added, and the drum contents are recompacted until a drum is filled. The drums are then sealed and moved to the waste storage area until shipped offsite. During compaction, the airflow in the vicinity of the compactor is directed by the compactor exhaust fan through a HEPA filter before it is discharged to the radwaste building ventilation exhaust.

Large or highly radioactive components and equipment that have been contaminated during reactor operation and that are not amenable to compaction or decontamination are handled either by qualified plant personnel or by outside contractors specializing in radioactive materials handling, and are packaged in shipping containers of an appropriate size and design.

11.4.2.3.3 Filter Handling and Disposal

The filters are separated into four classifications:

- Backflushable filter
- Completely disposable filter elements and vessel used in the backflushable filter crud collection system
- Cartridge type filters with disposable elements

INSERT A

Insert A to FSAR Page 11.4-17

Should the waste solidification subsystem be under repair, portable solidification system bypass lines and connections are provided to enable spent resins from the spent resin tanks to be diverted from the waste feed tank and sent directly to a portable solidification system located in the truck bay area for solidification. In addition, a bypass of the spent resin tanks is provided to allow sluicing directly from the ion exchangers in the radwaste and auxiliary buildings to the waste feed tank or the portable solidification system connection in the truck bay area.

Q. Environmental

1. The CVCS is provided with an environmental control system such that the safety-related equipment listed in appendix 3E operates within the environmental design limits specified in appendix 3E, as discussed in section 9.4.

R. Mechanical Interaction Between Components.

The portions of the CVCS that are part of the reactor coolant pressure boundary are designed to tolerate the events described in CESSAR Table 9.3.4-2.

9.3.4.3 Crud Removal Subsystem

9.3.4.3.1 System Design

The CVCS crud removal subsystem is designed to facilitate the collection and removal of suspended solids in the letdown which collects in the backflushable purification filter (shown in figure 9.3-13).

9.3.4.3.2 Components

The crud removal subsystem has the following components: crud tank, crud pump, crud filter, and crud tank vent filter.

The crud tank (CHN-X03) is a pressure vessel designed in accordance with ASME Section VIII. The tank is fabricated of austenitic stainless steel and is sized to accept backflushable purification filter discharges for one week. The upper portion of the tank has a spray that prevents particulates from being vented. Both overpressure and vacuum relief valves are connected to the tank.

The crud pump (CHN-P03) is a centrifugal type horizontal pump. It recirculates the contents of the crud tank to agitate any settled crud and bring it into suspension. It also pumps the

tank's contents through the crud filter and into the equipment drain tank.

The crud filter (CHN-F11) is a 5 micron rated disposable cartridge filter with integral, reusable, lead shield. Crud buildup on the filter is monitored by delta pressure drop across the filter.

The crud vent filter (CHN-F12) is a 1 micron rated disposable cartridge filter with integral, reusable, lead shield. This filter prevents radionuclide particulates from being discharged to the auxiliary building HVAC system.

9.3.4.3.3 Safety Design Bases

The crud removal subsystem has no safety design bases.

9.3.5 STANDBY LIQUID CONTROL SYSTEM (BWRs)

This section is not applicable to PVNGS.

9.3.6 COMPRESSED GAS STORAGE SYSTEMS

Compressed gas storage is provided for nitrogen (N_2), hydrogen (H_2), carbon dioxide (CO_2), air, and Halon 1301. Refer to section 9.5.1 for the description, safety design bases, and safety evaluation of the CO_2 and Halon 1301 storage subsystems. Section 10.3.2 provides a description of the N_2 accumulators for the atmospheric dump valves and safety design bases and evaluations. Compressed air system descriptions, safety design basis, and safety evaluations are provided in sections 9.3.1 and 9.5.6.

11.4 SOLID WASTE MANAGEMENT SYSTEM

Solid waste management is provided by the solid radwaste system (SRS) which is designed to provide holdup, solidification, and packaging of radioactive wastes generated by plant operation, and to store these wastes until they are shipped offsite for burial. The system is located in the radwaste building, which is designed to withstand an operating basis earthquake.

11.4.1 DESIGN BASES

The design bases of the solid waste management system are:

A. The SRS provides the capability for solidifying and packaging concentrated waste solutions from the miscellaneous waste evaporator, spent resins from radioactive ion exchangers, and chemical drain tank wastes.

B. The SRS provides a means for packaging and disposal of spent radioactive cartridge filters and solid wastes from the LRS, CVCS, and laundry (Unit 1 only). 7

C. The SRS provides a means of compacting and packaging miscellaneous dry radioactive materials, such as paper, rags, contaminated clothing, gloves, and shoe coverings, and a means for packaging contaminated metallic materials and incompressible solid objects, such as small tools and equipment parts.

D. The SRS provides an alternate method of disposal of the liquid and crud from the backflushable filter crud tank. Note that the crud is normally removed by a disposable filter and the liquid is normally processed by the chemical and volume control system discussed in section 9.3.4.

E. The SRS provides a method of solidifying and packaging blowdown demineralizer resin and condensate polishing resin in the event that they become contaminated.

The maximum and expected input volumes to the SRS from each source of solid waste material are presented in table 11.4-1. The SRS input activities associated with the expected input volumes are presented in table 11.4-2.

Codes and standards applicable to the solid radwaste system are listed in table 3.2-1.

Collection, solidification, packaging, and storage of radioactive wastes will be performed so as to maintain any potential radiation exposure to plant personnel to "as low as is reasonably achievable" (ALARA) levels, consistent with the recommendations of Regulatory Guide 8.8 and within the dose limits of 10CFR20. Some of the design features incorporated to maintain ALARA criteria include remote system operation, remotely actuated flushing, quick disconnect, equipment layout permitting the shielding of components containing radioactive materials, and use of shielded casks for in-plant movement of high activity waste. Additional ALARA provisions of the SRS are described in section 12.1.

Packaging and transport of radioactive wastes will be in conformance with 10CFR71. Packaged wastes will be shipped in conformance with 49CFR170-178. Collection, solidification, packaging, and storage of radioactive wastes will be performed in conformance with 10CFR50.

Laundry is cleaned by a dry-cleaning system. Solid wastes are
7 manually transfered to the SRS for packaging. Refer to
section 12.5.2.

Table 11.4-1

SRS INPUT VOLUMES (PER UNIT)

Source (Form)	Expected Volume (ft^3/yr)	Maximum Volume (ft^3/yr)	Bases	
Wet Waste				
Evaporator concentrates	3,224	69,877	Regulatory Guide 1.112 April, 1976	
Spent resin	430	430	Reference 1	
~~Crud tank~~	~~0~~	~~190~~	~~Note 1~~	
Chemical drain tank	0	294	Note 1	
Blowdown demineralizer resin	0	282	Note 2	
Condensate polishing resin	0	1,872	WASH 1258	9
Dry Waste				
Compactable and noncompactable dry wastes	11,091	11,091	AIF/NESP-008 (2)	
Filters				
~~Low activity~~ cartridge filters (dry)	~~7.3~~ 10.3	34.2	Reference 1	10
~~Disposable crud filters (dry)~~	~~3.8~~	~~3.8~~	~~Note 3~~	9
Total (ft^3/yr)	14,755 ~~14,757~~	83,880 ~~84,074~~		10

NOTES:

1. ~~The crud tank contents are normally processed by the chemical and volume control system.~~ The chemical drain tank contents are normally processed by the liquid radwaste system. Maximum volume is based on an additional complete flush of each tank directly to the SRS per year. 4 10

2. Blowdown demineralizer resin is not normally changed more than once per year. Maximum volume is based on change out of both demineralizers during one year. 10

~~3. Based on change out of crud filters twice per year.~~

Table 11.4-2

SRS INPUT ACTIVITIES[a] (Ci/yr) (Sheet 1 of 4)

(PER UNIT)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
BR-83	0.0	2.8 (-01)	0.0	0.0	(b)
BR-84	0.0	3.3 (-02)	0.0	0.0	(b)
BR-85	0.0	3.5 (-04)	0.0	0.0	(b)
I-129	0.0	0.0	0.0	0.0	(b)
I-130	1.3 (-03)	6.2 (-01)	0.0	0.0	(b)
I-131	1.3	1.2 (+03)	0.0	0.0	(b)
I-132	1.1 (-01)	5.4	0.0	0.0	(b)
I-133	3.1 (-01)	1.9 (+02)	0.0	0.0	(b)
I-134	2.1 (-02)	9.8 (-01)	0.0	0.0	(b)
I-135	9.1 (-02)	3.1 (+01)	0.0	0.0	(b)
RB-86	0.0	0.0	0.0	0.0	(b)
RB-88	0.0	9.5 (-01)	0.0	0.0	(b)
RB-89	0.0	0.0	0.0	0.0	(b)
CS-134	3.2 (-01)	1.5 (+03)	0.0	0.0	(b)
CS-136	1.0 (-01)	5.8 (+01)	0.0	0.0	(b)

a. Expected waste generation conditions only, maximum waste generation conditions are not tabulated because they are short-term inputs that are not representative of a year's continuous operation.

b. Nuclide breakdown was not made. Total activity is based on ~~WASH 1258 estimates~~ ONWI-20 data.

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Amendment 13

Table 11.4-2

SRS INPUT ACTIVITIES[a] (Ci/yr) (Sheet 2 of 4)

(PER UNIT)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
CS-137	2.4(-01)	1.2(+03)	0.0	0.0	(b)
CS-138	0.0	0.0	0.0	0.0	(b)
N-16	0.0	5.0(-04)	0.0	0.0	(b)
H-3	1.3(+01)	0.0	0.0	0.0	(b)
Y-90	1.5(-04)	1.7(-03)	0.0	0.0	(b)
Y-91M	3.3(-04)	6.7(-03)	0.0	0.0	(b)
Y-91	0.0	1.9	0.0	0.0	(b)
Y-93	8.8(-05)	7.5(-03)	0.0	0.0	(b)
MO-99	1.1	1.2(+02)	0.0	0.0	(b)
SR-89	4.0(-03)	9.1	0.0	0.0	(b)
SR-90	1.3(-04)	1.0	0.0	0.0	(b)
SR-91	4.3(-04)	1.4(-01)	0.0	0.0	(b)
ZR-95	6.9(-04)	1.9	~~[illegible]~~ 1.9	1.7	(b)
NB-95	6.8(-04)	9.1(-01)	0.0	0.0	(b)
TC-99M	1.1	6.2	0.0	0.0	(b)
RU-103	4.8(-04)	9.3(-01)	0.0	0.0	(b)
RU-106	1.3(-04)	8.1(-01)	0.0	0.0	(b)
RH-103M	4.8(-04)	9.4(-01)	0.0	0.0	(b)
RH-106	1.3(+01)	2.9(-0[illegible])	0.0	0.0	(b)

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March 1984

Table 11.4-2

SRS INPUT ACTIVITIES(a) (Ci/yr) (Sheet 3 of 4)

(PER UNIT)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
TE-125M	0.0	0.0	0.0	0.0	(b)
TE-127M	3.4(-03)	1.3(+01)	0.0	0.0	(b)
TE-127	0.0	1.9(-01)	0.0	0.0	(b)
TE-129M	1.5(-02)	2.5(+01)	0.0	0.0	(b)
TE-129	5.2(-03)	4.4(-02)	0.0	0.0	(b)
TE-131M	0.0	0.0	0.0	0.0	(b)
TE-131	0.0	0.0	0.0	0.0	(b)
TE-132	7.5(-02)	5.0(+01)	0.0	0.0	(b)
TE-134	0.0	0.0	0.0	0.0	(b)
BA-137M	2.3(-01)	1.7(-02)	0.0	0.0	(b)
BA-140	1.6(-02)	1.5	0.0	0.0	(b)
LA-140	1.6(-02)	1.3(-01)	0.0	0.0	(b)
CE-141	7.2(-04)	1.2	0.0	0.0	(b)
CE-143	5.6(-05)	2.9(-02)	0.0	0.0	(b)
CE-144	4.2(-04)	2.5	0.0	0.0	(b)
PR-143	4.3(-04)	3.5(-01)	0.0	0.0	(b)
PR-144	4.3(-04)	2.1(-04)	0.0	0.0	(b)
NP239	2.6(-03)	1.5	0.0	0.0	(b)
CR-51	1.9(-02)	2.7	~~2.8(+01)~~ 8.3(+01)	1.6(+02)	(b)

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Table 11.4-2
SRS INPUT ACTIVITIES[(a)] (Ci/yr) (Sheet 4 of 4)
(PER UNIT)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
MN-54	4.0(-03)	2.4	9.6	9.3	(b)
FE-55	0.0	1.5(+01)	0.0	0.0	(b)
FE-59	1.1(-02)	2.3	1.5	1.5	(b)
CO-58	1.9(-01)	5.7(+01)	3.8(+02)	3.7(+02)	(b)
CO-60	2.6(-02)	2.0(+01)	1.2(+02)	1.2(+02)	(b)
TOTAL	3.1(+01)	4.5(+03)	6.0(+02)	5.8(+02)	8.0(+01)

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H. Radwaste Baler

The radwaste baler is used to package low-radiation level, solid compressible wastes in standard 55-gallon drums. The primary function of the baler is to reduce the volume of wastes that often contain a large void space. Potentially radioactive air which escapes from the drum during compaction is exhausted by the baler exhaust fan through a HEPA filter to the radwaste building ventilation exhaust. The drums of compacted waste are moved by the bridge crane, forklift, or dolley to the low activity storage area to await off-site shipment.

11.4.2.3 System Operation

11.4.2.3.1 Liquid Waste and Spent Resin Disposal

The waste solidification system operates on a batch basis to solidify chemical drain tank waste, evaporator concentrates, and spent resins~~, and crud tank waste~~. It is also used to encase spent radioactive cartridge filters and other miscellaneous contaminated objects. The system is designed to solidify spent blowdown demineralizer resin and spent condensate polishing resin if required. Sufficient capacity is provided to solidify radioactive wastes resulting from normal plant operations and anticipated operational occurrences.

Liquid inputs from the concentrate monitor tanks, the chemical drain tanks, ~~the crud tank,~~ and the spent resin tanks are fed into the waste feed tank for hold up and chemical treatment prior to solidification. The waste feed pump transfers waste from the waste feed tank through an in-line pH probe and a three-way valve which directs waste back to the tank (recirculation mode) or to the radwaste/cement mixer. The recirculation mode is for sampling and chemical adjustment. After the required chemical adjustments are made, the waste is pumped to

Topical Report for Radwaste Solidification System (Cement). Instrumentation and control devices provided are shown on figure 11.4-2. The capability is provided to perform on-truck solidification of evaporator bottoms using various sizes of disposable liners if the need should arise.

11.4.2.3.2 Dry Waste Disposal

Potentially radioactive dry wastes are collected at appropriate locations throughout the plant as dictated by the volume of these wastes generated during operation or maintenance. As necessary, these wastes are taken to the radwaste building for packaging, where they are first compressed in drums to minimize shipping volume. Additional compressible material is added, and the drum contents are recompacted until a drum is filled. The drums are then sealed and moved to the waste storage area until shipped offsite. During compaction, the airflow in the vicinity of the compactor is directed by the compactor exhaust fan through a HEPA filter before it is discharged to the radwaste building ventilation exhaust.

Large or highly radioactive components and equipment that have been contaminated during reactor operation and that are not amenable to compaction or decontamination are handled either by qualified plant personnel or by outside contractors specializing in radioactive materials handling, and are packaged in shipping containers of an appropriate size and design.

11.4.2.3.3 Filter Handling and Disposal

The filters are separated into two ~~four~~ classifications:

- ~~Backflushable filter~~
- ~~Completely disposable filter elements and vessel used in the backflushable filter crud collection system~~
- Cartridge type filters with disposable elements

- Unshielded low activity filters with disposable elements

One CVCS purification filter, located at the 120-ft elevation of the auxiliary building, is backflushable. The completely disposable filters utilized in the backflushable filter crud collection system are shielded with a reusable lead cask. The completely disposable filters employed are:

- One disposable shielded crud filter (section 9.3.4)
- One disposable shielded crud vent filter (section 9.3.4)

These filters are located in the auxiliary building (elevation 120) and are shown on figure 1.2-6.

The disposable crud system filters are located in a compartment which is accessed by removing panels above the lead shielded filters. In order to change out a filter, the lead shield is unbolted from its foundation and the filter is uncoupled from its piping system. The lead shield encased filter is then lifted off of its foundation, using the monorail hoist, and the free pipe ends are capped to prevent leakage. The lead shield encased filter is then transported via monorail to the radwaste building for subsequent shipment to an NRC approved burial site. The filter is removed from the shield and is disposed of at the burial site and the shield is returned to the plant for reuse.

The following are cartridge type filters:

- One reactor makeup water filter (section 9.3.4)
- One boric acid filter (section 9.3.4)
- One reactor drain tank filter (section 9.3.4)
- Two seal injection filters (section 9.3.4)
- Two fuel pool filters (section 9.1.3)
- Two liquid radwaste system filters (section 11.2)
- ~~One backup~~ purification filters (section 9.3.4)

Two

Table 11.4-5
SRS OUTPUT VOLUMES PER UNIT

Source	Expected Volume (ft^3/yr)	Maximum Volume (ft^3/yr)	Containers Shipped: Large Containers (expected/max/yr)	Containers Shipped: Drums of Solidified Waste (expected/max/yr)	Containers Shipped: Drums of Baled Waste (expected/max/yr)	
Wet Waste						
Evaporator concentrates	4,299	93,169	54/1,165	585/12,677	-	9
Spent resin beads	1,147	6,891	16/87	158/938	-	10
Chemical drain tank effluent	0	420	0/0	0/58	-	
~~Crud tank effluent~~	~~0~~	~~271~~	~~0/0~~	~~0/37~~	~~-~~	
Dry Waste						9
Baled waste	3,697	3,697	-	-	503/503	
Filters						
~~Low activity~~ cartridge filters	160 ~~135~~	610	-	22 ~~17~~/83	-	10
~~Disposable crud filters(a)~~	~~3.8~~	~~3.8~~	~~-~~			9
Total	9303 ~~9,272~~	104,787 ~~105,062~~	70/1,252	765/13,756 ~~760/13,793~~	503/503	10

~~a. Crud Filters are shipped in reuseable casks~~

Table 11.4-6

SRS OUTPUT ACTIVITIES[a] (Ci/yr/unit) (Sheet 1 of 4)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
BR-83	0.0	0.0	0.0	0.0	(b)
BR-84	0.0	0.0	0.0	0.0	(b)
BR-85	0.0	0.0	0.0	0.0	(b)
I-129	2.3(-11)	2.6(-07)	0.0	0.0	(b)
I-130	8.9(-12)	0.0	0.0	0.0	(b)
I-131	3.8(-01)	6.8(-05)	0.0	0.0	(b)
I-132	3.9(-03)	5.4(-17)	0.0	0.0	(b)
I-133	4.7(-06)	0.0	0.0	0.0	(b)
I-134	0.0	0.0	0.0	0.0	(b)
I-135	7.3(-17)	0.0	0.0	0.0	(b)
RB-86	0.0	0.0	0.0	0.0	(b)
RB-88	0.0	0.0	0.0	0.0	(b)
RB-89	0.0	0.0	0.0	0.0	(b)
CS-134	3.2(-01)	1.3(+03)	0.0	0.0	(b)
CS-136	4.7(-02)	1.9(-03)	0.0	0.0	(b)
CS-137	2.4(-01)	1.2(+03)	0.0	0.0	(b)

a. Expected waste generation conditions only. Maximum waste generation conditions are not tabulated because they are short-term inputs that are not representative of 1 year's continuous operation.

b. Nuclide breakdown was not made. Total activity is based on ~~WASH-1268 estimates~~ ONWI-20 data.

Amendment

Table 11.4-6

SRS OUTPUT ACTIVITIES[a] (Ci/yr/unit) (Sheet 2 of 4)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
CS-138	0.0	0.0	0.0	0.0	(b)
N-16	0.0	0.0	0.0	0.0	(b)
H-3	1.3(+01)	0.0	0.0	0.0	(b)
Y-90	1.3(-04)	9.9(-01)	0.0	0.0	(b)
Y-91M	1.3(-10)	0.0	0.0	0.0	(b)
Y-91	5.3(-06)	1.9(-01)	0.0	0.0	(b)
Y-93	2.3(-15)	0.0	0.0	0.0	(b)
MO-99	3.3(-02)	8.1(-20)	0.0	0.0	(b)
SR-89	3.3(-03)	6.3(-01)	0.0	0.0	(b)
SR-90	1.3(-04)	9.9(-01)	0.0	0.0	(b)
SR-91	1.8(-14)	0.0	0.0	0.0	(b)
ZR-95	6.0(-04)	2.4(-01)	~~1.4~~ 1.3	1.7	(b)
NB-95	6.8(-04)	4.9(-01)	~~0.0~~ 7.0(-01)	0.0	(b)
TC-99M	4.9(-02)	6.0(-17)	0.0	0.0	(b)
RU-103	3.7(-04)	3.1(-02)	0.0	0.0	(b)
RU-106	1.3(-04)	5.6(-01)	0.0	0.0	(b)
RH-103M	3.7(-04)	3.1(-02)	0.0	0.0	(b)
RH-106	1.3(-04)	5.6(-01)	0.0	0.0	(b)
TE-125M	0.0	0.0	0.0	0.0	(b)

Table 11.4-6
SRS OUTPUT ACTIVITIES[a] (Ci/yr/unit) (Sheet 3 of 4)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
TE-127M	3.1(-03)	3.8	0.0	0.0	(b)
TE-127	3.1(-03)	3.8	0.0	0.0	(b)
TE-129M	1.1(-02)	4.7(-01)	0.0	0.0	(b)
TE-129	7.8(-03)	1.3	0.0	0.0	(b)
TE-131M	0.0	0.0	0.0	0.0	(b)
TE-131	0.0	0.0	0.0	0.0	(b)
TE-132	3.7(-03)	5.4(-17)	0.0	0.0	(b)
TE-134	0.0	0.0	0.0	0.0	(b)
BA-137M	2.3(-01)	1.1(+03)	0.0	0.0	(b)
BA-140	7.7(-03)	4.1(-05)	0.0	0.0	(b)
LA-140	8.9(-03)	4.7(-05)	0.0	0.0	(b)
CE-141	5.4(-04)	1.9(-02)	0.0	0.0	(b)
CE-143	4.8(-08)	0.0	0.0	0.0	(b)
CE-144	4.0(-04)	1.6	0.0	0.0	(b)
PR-143	2.1(-04)	1.8(-05)	0.0	0.0	(b)
PR-144	4.8(-08)	1.6	0.0	0.0	(b)
NP-239	4.1(-05)	2.1(-25)	0.0	0.0	(b)
CR-51	1.4(-02)	2.1(-02)	~~2.7(+01)~~ 3.9(+01)	1.6(+02)	(b)
MN-54	3.9(-03)	1.6	9.0 2.4(+01)	3.6	(b)
FE-55	0.0	0.0	~~1.5(+03)~~ 0.0	0.0	(b)

Amendment 13

Table 11.4-6
SRS OUTPUT ACTIVITIES[(a)] (Ci/yr/unit) (Sheet 4 of 4)

Nuclide	Evaporator Concentrates	Spent Resin Beads	Cartridge Filters	Disposable Crud Filters	Dry Wastes
FE-59	8.9(-03)	1.1(-01)	9.8(-01)	9.5(-01)	(b)
CO-58	1.6(-01)	8.6	2.9(+02)	2.8(+02)	(b)
CO-60	2.6(-02)	1.9(+01)	1.2(+02)	1.2(+02)	(b)
TOTAL	1.5(+01)	3.6(+03)	4.6(+02)	4.5(+02)	8.0(+01)

13

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12.3.1.1.1.1 Filters. Filters in the auxiliary building that 12 accumulate radioactive particles are supplied with the means ~~either to backflush the filter remotely or~~ to perform cartridge replacement with remote tools. Cartridge replacement of the blowdown demineralizer filter will utilize long handled tools.

Cartridge filters have adequate space for removal, cask loading, and transport. A filter handling system has been incorporated into PVNGS for all filters except the low activity blowdown demineralizer filter. In use, the handling system is placed over the filter in the space normally occupied by its concrete hatch. The lead base of the system adequately attenuates cartridge radiation. A remote, closed circuit TV and a leaded glass window provide the operator with a complete view of the filter housing and cartridge while he is performing the changeout with remote tools. The cartridge can then be lifted into a shield cask placed on the base. The operator is never exposed to unattenuated radiation from the cartridge. An overhead monorail is used to transport cask and cartridge to the radwaste storage area.

Backflushable filters are designed so that filter internals may be remotely removed and placed in a shielded cask for offsite shipping and disposal in the unlikely event that a filter loses its backflush capability. Backflushable filter compartments are designed to be flooded for this operation, and long-handled tools are provided for removal of filter internals from the hatch above the flooded compartment.

12.3.1.1.1.2 Ion Exchangers. With the exception of potentially radioactive blowdown processing system ion exchangers, ion exchangers for radioactive systems are designed so that spent resins can be remotely and hydraulically

12.3.1.1.1.5 Tanks. Tanks in radioactive and potentially radioactive systems are provided with sloped bottoms and bottom outlet connections whenever practical.

A. Tanks with flat bottoms sloped toward the outlet include:

1. Reactor makeup water tank
2. Radwaste holdup tanks
3. Refueling water tank
4. CVCS holdup tank
5. Liquid radwaste evaporator condensate storage tanks
6. Condensate storage tank
7. Chemical waste tanks
8. Liquid radwaste monitor tanks

These tanks have outlet connections located on the side of the tank as near to the bottom as possible.

B. Tanks with rounded bottoms and low point outlet connections include:

1. Spent resin tanks

~~2. Filter crud tank~~

2 ~~3.~~ Volume control tank

3 ~~4.~~ Reactor drain tank

4 ~~5.~~ Chemical drain tank

5 ~~6.~~ Equipment drain tank

Overflow lines are directed to the liquid radwaste system to
12 control contamination within plant structures. Tanks are contained in separate compartments with drains directed to the liquid radwaste system or the chemical and volume control system.

chemical and volume control system, the shutdown cooling system, the fuel pool cooling and cleanup system and the primary sampling system.

Shielding is provided as necessary around the following equipment in the auxiliary building to ensure the design radiation zone and access requirements are met for surrounding areas. 12

A. Letdown heat exchangers and piping

B. Purification, preholdup, and deborating ion exchangers

C. Chemical and volume control tank

D. Charging pumps and piping

E. Shutdown cooling heat exchangers

F. Chemical drain tanks and pumps

G. CVCS and radwaste filters

H. Spent fuel pool cleanup ion exchangers and filters

I. Spent resin tanks and piping

J. Gas stripper

K. Seal injection heat exchanger

L. Boronometer

M. Process radiation monitor

N. Seal injection filters

~~O. Crud filters, tank, and pump~~

Shielding is based upon operation with maximum activity conditions as discussed in sections 11.1, 11.2, 11.3, and 12.2.1.

Depending on the equipment in the compartments, the access varies from design radiation Zones 2 through 5. Corridors are shielded to allow design radiation Zone 2 access. Operator areas for valve galleries are designed for design radiation Zone 3 access. Frequently operated valves in high radiation 12

12 areas are provided with remote actuators extending to design radiation Zone 2 or Zone 3 areas. (See section 12.1.2.3.2M.)

Removable sections of block shield walls, or concrete hatches with offset gaps to reduce radiation streaming are provided for replacement of ion exchangers, ~~backflushable filter~~, pumps, and heat exchangers.

12.3.2.2.4 Fuel Building Shielding Design

Concrete shield walls surrounding the spent fuel cask loading and storage area, fuel transfer and storage pools, and fuel transfer tube between the containment and fuel transfer pool are sufficiently thick to limit radiation levels outside the
12 shield walls in accessible areas to design radiation Zone 2. Access to the fuel transfer tube through the concrete radiation shield is provided by a heavy concrete hatch through the roof
5 of the shield as shown in figure 12.3-23. The hatch is labeled to caution maintenance personnel that there are potentially lethal radiation fields during fuel transfer.

Water in the spent fuel pool provides shielding above the spent fuel transfer and storage areas. The relationship between
5 dose rate over spent fuel during transfer and depth of covering water is shown in figure 12.3-24. Radiation levels at the
12 fuel handling equipment are not expected to exceed 2.5 mrem/h.

The spent fuel pool cooling and cleanup (SFPCC) system (section 9.1) shielding is based on the maximum activity
12 discussed in section 12.2 and the access and design zoning requirements of adjacent areas. Equipment in the SFPCC system to be shielded includes the SFPCC heat exchangers, pumps and piping. (SFPCC filters and ion exchangers are located in the auxiliary building.)

12.3.2.2.5 Radwaste Building Shielding Design

Radwaste systems are principally located in the radwaste building. Additionally, the boric acid concentrator and the

F. Functional Group Display

The functional group display is a multi-page, tabular display listing all of the monitor channels of a specified channel type. The desired channel type is a display parameter and is specified along with the display request. The information on the display is presented as one line for each channel. 12

11.5.2.1.1.5.4 Automatic Controls. Provides automatic control of each channel by the associated field unit microcomputer. Automatic control includes the following, as applicable to the particular channel type:

A. Automatic activation of the check source and monitoring for a proper response at regular intervals specified in the channel critical parameter file.

B. Automatic stepping of a particulate channel moving paper filter at regular intervals specified in the channel critical parameter file.

C. Automatic sample flow control based on input of HVAC flow signals to microcomputer. This allows sample flow to be isokinetic

11.5.2.1.1.5.5 Remote Manual Controls. Provides remote manual control of each channel through operation of DCU

iodine channels, the sampler is a lead-shielded filter assembly. Four ½ shielding is furnished for all process and effluent detectors.

Airborne particulate and iodine monitors and samplers,
12 (XJ-SQN-RU-08, -RU-14, -RU-141, -RU-142, -RU-143, -RU-144, -RU-145 and XJ-SQB-RU-146) sample isokinetically in accordance with the principles and methods of ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities. The particulate and iodine sample flow is maintained constant over the normal expected range of filter paper and/or charcoal cartridge differential pressure by an automatic control system. Local flow indication and high- and low sample flow alarm signals are provided. These signals actuate local alarms and the channel failure alarm. Two Particulate monitors ~~samplers~~ ~~only (except for~~ XJ-SQN-RU-08 ~~141,~~
12 ~~-RU-142, -RU-144~~ and XJ-SQB-RU-14 ~~146~~) are moving paper filter type and incorporate microcomputer-controlled step advance, and feed failure channel failure alarm. Sampling assembly fittings are provided which allow grab sampling of the monitored airstreams.

The automatic control system maintains isokinetic flow based on a comparison of sample flow to HVAC duct flow. The HVAC duct flow input is performed manually for XJ-SQN-RU-08 and -RU-14 and automatically for XJ-SQN-RU-141 thru -RU-146.

A flow-integrating elapsed sample volume indicator is provided downstream of each particulate and/or iodine channel. It has a local digital readout and is resettable to zero.

7 Particulate collection efficiency is greater than 90% for 0.3m particulates. Volatile iodine adsorption efficiency is greater than 90%.

11.5.2.1.1.7.3 Detector Assembly. The detector assembly is a completely weatherproofed assembly, housing a detector, preamplifier, and radiation check source. The assembly is capable of withstanding the design pressure and temperature of the piping system of which it is a part, without leakage, collapse of the tube walls, or damage to the detector.

The detector assembly is incorporated in the sampler assembly.

11.5.2.1.4.2 <u>Plant Vent (XJ-SQN-RU-143 and XJ-SQN-RU-144)</u> 12
<u>(PVLR, PVHR) Monitor</u>. The plant vent exhaust is continuously
and isokinetically monitored for particulate, I-131, and
gaseous activity.

A low and a high range monitor is used to cover a range of 5
twelve ~~fourteen~~ decades with one ~~two~~ decades of overlap. Shielded
particulate and iodine samples exist in the high monitor and 12
are removed for analysis. The low range iodine and particulate 5
samples have a 5 decade detection range. 12

11.5.2.1.4.3 <u>Fuel Building Ventilation Exhaust Monitor,</u> 12
<u>(FBLR, FBHR) Channel "B" (XJ-SQB-RU-145 and XJ-SQB-RU-146)</u>.
The fuel building exhaust is continuously and isokinetically monitored
for particulate, I-131 and gaseous activity.
~~This~~ The gaseous channel also monitors the fuel building ventilation
exhaust for release of activity due to a fuel handling accident.
The fuel building exhaust is continuously and isokinetically sampled for particulate and I-131.
The monitor performs the safety function of isolating the
normal ventilation system and activating the essential ventila-
tion system (initiates a FBEVAS signal) on a HIGH-HIGH activity
alarm. Redundancy and diversity are provided by the fuel pool
area monitor (JSQARU31) that also actuates the essential 12
ventilation system. Refer to section 7.3 for a discussion of
the safety function of the Fuel Building Ventilation Exhaust 12
monitor. During normal operation the only significantly
abundant isotope which would be released from the fuel build-
ing is tritium; therefore, gaseous activity is monitored and particulate and I-131 ~~monitoring~~ sampling 12
capability is provided ~~, but not required~~.

A low and a high range monitor is used to cover a range of 5
twelve ~~eleven~~ decades with one ~~two~~ decades of overlap. Particulate/iodine
cartridge samples exist in the low and high range monitor and
are removed for analysis. High range cartridge samplers are
shielded. Both monitors share the same sample line from the 12
fuel building HVAC. When a FBEVAS signal is generated, a
class 1E HEPA filter system is placed into operation upstream
of the monitors' sample point. Thus filtration will be in
operation for the upper range of detection for the low range

12 monitor and throughout the range of detection for the high range monitor. Because the fuel building HEPA filters operate at 6000 cfm and remove particulates greater than 0.3 microns (see FSAR section 9.4.5.2) the high range monitor is sampling isokinetically within the guidelines of ANSI N13.1-1969.

11.5.2.1.5 Area Radiation Monitoring

12 One function of area radiation monitors (except for XJ-SQA-RU-37 and XJ-SQB-RU-38) listed in table 11.5-1 is to indicate and alarm locally and remotely the area dose rate to ensure proper personnel radiation protection. Several of the area monitors also perform other additional functions or have unique characteristics:

12 11.5.2.1.5.1 Central Calibration Facility Area (XJ-SQN-RU-24) (CFA) Monitor. The CFA monitor is located in a small outbuilding in the yard of Unit 1 which is shared by all three Units as a central calibration facility.

12 11.5.2.1.5.2 Waste Solidification System Process Control Area (PCA) (XJ-SQN-RU-27 and J-SQN-RU-28) Monitors. These two monitors are not connected to any of the communications loops of the RMS. They are permanently in LOCAL control and are integral parts of the control system for the Waste Solidification System. Refer to section 11.4.2.3.1 for a description of their functions.

2 11.5.2.1.5.3 Deleted

12 11.5.2.1.5.4 Fuel Pool Area Monitor, Channel "A" (FPAA) (XJ-SQA-RU-31). The monitor is located on a wall overlooking the fuel pool where it monitors for a release of activity due to a fuel handling accident in the fuel building. The monitor performs the safety function of isolating the normal ventilation system and activating the essential ventilation system on

Table 11.2-1

4 LIQUID RADWASTE SYSTEM (LRS) EQUIPMENT DESCRIPTIONS
(Sheet 4 of 7)

Pumps (Continued)		
Anti-Foam Pump (P-07)		
Quantity/unit	=	1
Type	=	Positive displacement
Capacity	=	54 gal/h
11 Design pressure/temp	=	93 psig/175F
Material	=	316 SS
Motor rpm/bhp	=	1725/0.5
Recycle Monitor Pump (P-03)		
Quantity/unit	=	1
Type	=	Centrifugal
Capacity	=	150 gal/min
11 Design pressure/temp	=	275 psig/100F
Material	=	316L SS
Motor rpm/bhp	=	3600/10
LRS Evaporator Main Recycle Pump (P-08)		
Quantity/unit	=	1
Type	=	In-line propeller
Capacity	=	10,500 gal/min
Design pressure/temp	=	~~40 psig/250F~~ 5 psig/230F
Material	=	Carpenter 20 Cb-3
~~Motor~~ Pump rpm/bhp	=	~~1750/75~~ 714
Motor bhp	=	75
LRS Evaporator Distillate Pumps (P-09 A,B)		
Quantity/unit	=	2
Type	=	Centrifugal
Capacity	=	30 gal/min
Design pressure/temp	=	~~34 psig/250F~~ 58 psig/220F
Material	=	316 SS
11 Motor rpm/bhp	=	3500/5

Table 11.2-1

LIQUID RADWASTE SYSTEM (LRS) EQUIPMENT DESCRIPTIONS (Sheet 5 of 7) 4

Pumps (Continued)		
LRS Evaporator Concentrate Pumps (P-10 A,B)		
Quantity/unit	=	2
Type	=	Centrifugal
Capacity	=	50 gal/min
Design pressure/temp	=	~~35 psig/224F~~ 16 psig/235F
Material	=	Gould-a-loy 20
Motor rpm/bhp	=	1750/2 11
LRS Steam Condensate Pump (P-11)		
Quantity/unit	=	1
Type	=	Centrifugal
Capacity	=	40 gal/min 11
Design pressure/temp	=	~~35 psig/281F~~ 61 psig/270F
Material	=	316 SS
Motor rpm/bhp	=	3505/5
Concentrate Monitor Tank Pumps (P-04 A,B)		
Quantity/unit	=	2
Type	=	Centrifugal
Capacity	=	130 gal/min
Design pressure/temp	=	275 psig/100F
Material	=	W20 11
Motor rpm/bhp	=	1770/30
Filters		
LRS Ion Exchanger Prefilters (F-01 A,B)		
Quantity/unit	=	2
Size	=	5 µm 98%, 25 µm 100%
Capacity	=	150 gal/min
Design pressure/temp	=	200 psig/250F

annunciated in the main control room and in the radwaste control room. Operating personnel can be dispatched to mitigate the situation via nitrogen dilution, purge, etc. An alarm on high-high oxygen (4%), from any of these sources is annunciated in
6 the main control room and in the radwaste control room. Under these conditions the waste gas compressors will automatically trip, and nitrogen will be automatically injected into the GRS surge tank. Automatic nitrogen dilution will mitigate the situation. In addition, low surge tank pressure automatically initiates an alarm to alert operating personnel of a tank leak which could potentially result in oxygen inleakage to the system. Thus, it is not necessary for the waste gas surge header, surge tank, decay tanks, valves, piping, and compressors to be designed to withstand an internal hydrogen explosion.

~~After a suitable storage period, the gas is released to the radwaste building exhaust vent.~~ Insert A ~~The release rate is controlled by a flow controller set for a maximum discharge of 50 standard ft^3/min.~~ The air-flow rate through the vent is 25,500 standard ft^3/min, which results in a hydrogen concentration of less than 1%, well below the combustion limit of hydrogen in air. The gaseous discharge isolation valves will automatically shut on high discharge flow rate, low radwaste building exhaust or high radiation level in the discharge line.

Potential buildup of hydrogen in the ventilation exhaust systems can come from storage tanks that contain liquids previously processed through the gas stripper. Consequently, with a gas stripper efficiency of 99.9% and a maximum hydrogen pressure of 50 psig (administrative limit) in the volume control tank, the maximum hydrogen concentration that can exist in the gas space above a liquid surface downstream of the gas stripper is 0.44%, well below the combustion limit of hydrogen in air.

Another potential source of hydrogen is liquids fed to the equipment drain tank and chemical drain tanks, but these will contain only small quantities of dissolved hydrogen. The

Insert A

page 11.3-8

After a suitable storage period, the gas is released to the radwaste building exhaust vent, through a split path. The primary path is controlled by a flow controller at a maximum rate of 45 standard ft^3/min. The secondary path flows through a pressure reducer to allow flow through a radiation monitor at 5 standard ft^3/min. The ✓ total release rate is 50 standard ft^3/min.

maximum

11.3.1.1.5 Instrumentation

The GRS instrumentation is shown in figure 11.3-2. The hydrogen and oxygen analyzers are discussed in section 9.3.2. The GRS radiation monitors are discussed in section 11.5. Compressor instrumentation necessary for operation can be read at a local panel outside the compressor room. Remote indication and alarms are provided in the radwaste system control panel area in the radwaste building. GRS alarm conditions are retransmitted to the main control room.

The automatic isolation valves in the decay tank discharge header are interlocked to close on high radiation signals from the waste gas header monitor, high discharge flow, or low radwaste building exhaust flow. Therefore, even during the improbable instance where the discharge valve from the wrong decay tank is inadvertently opened, the release would be automatically terminated when the radiation setpoint is exceeded. The resultant activity released to the environment would be within Plant technical specifications limits for radioactive gaseous releases ~~described in chapter 16.~~

11.3.1.1.6 Hydrogen Control

The major sources of hydrogen in the GRS are the off-gas from the gas stripper, the volume control tank, and the reactor drain tank. These sources will produce a gas consisting primarily of hydrogen and nitrogen with trace quantities of oxygen and fission gases. These sources are piped to the waste gas surge tank from which gas is compressed into decay tanks.

The GRS and its input sources are initially purged at plant
startup with nitrogen. The surge tank (gas surge header), decay
tanks, and various input sources are monitored for oxygen and 6
hydrogen as described in section 9.3.2. The hydrogen and oxygen
analyzer sequentially samples the major GRS inputs and on-line 4
decay tank, and continuously samples the gas surge tank. An
alarm on high oxygen (2%) from any of these sources is 6

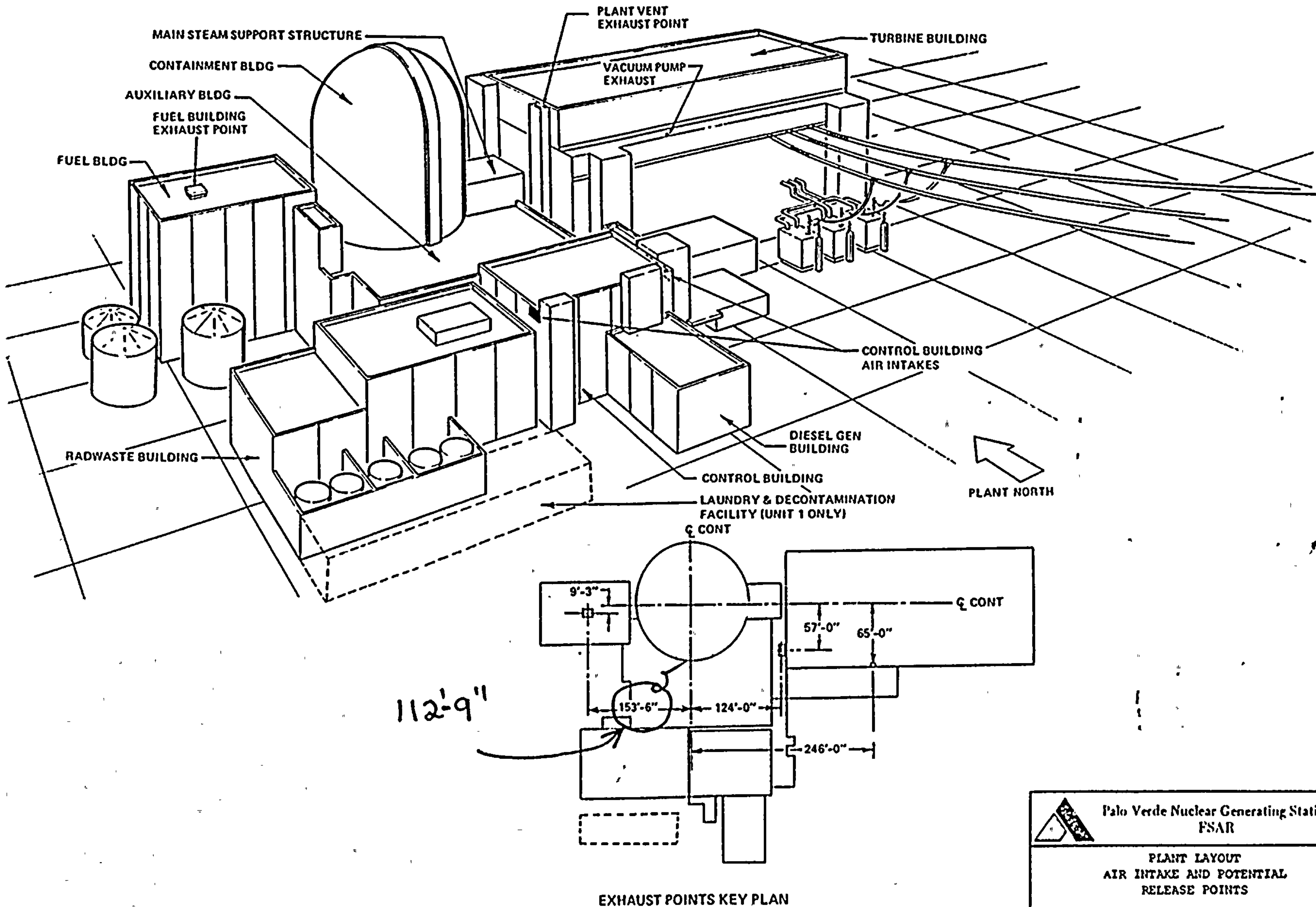
Sources for the GRS include the gases from:

- Reactor drain tank
- Volume control tank
- Refueling failed fuel detectors
- Gas stripper
- Reactor vessel vent

The high-activity gases accumulate in the waste gas surge tank and are compressed and stored in the waste gas decay tanks. When the surge tank pressure reaches 3 psig, the compressor selected for operation starts automatically and starts charging the online decay tank. If the surge tank pressure reaches 3.5 psig the standby compressor will automatically start. Operation of either compressor automatically stops when the surge tank pressure decreases to 0.5 psig. When decay tank pressure reaches 350 psig, an alarm is actuated, and compressor operation is terminated manually. Identical compressors are provided to minimize system down time.

Each decay tank is sampled prior to discharge. No special mixing is considered necessary for the gas. Each sample is analyzed for radioactivity and the concentration, volume, and total radioactivity are recorded. Isotopic content of the waste gases is determined and recorded as specified in the station manual procedures.

The maximum rates and quantities of radionuclides released from the gaseous waste decay tanks will be in accordance with the limits imposed by the Plant Technical Specifications. ~~of chapter 16~~. The rate of release from the decay tanks into the ventilation exhaust is limited so as not to exceed the release limits of 10CFR20. Releases are conducted to meet the "as low as is reasonably achievable" objectives of 10CFR50 Appendix I.



Palo Verde Nuclear Generating Station
FSAR

PLANT LAYOUT
AIR INTAKE AND POTENTIAL RELEASE POINTS

Figure 6.4-1