PACIFIC GAS AND ELECTRIC COMPANY

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November 19, 1971

Mr. L. D. Low
Director
Division of Compliance
U. S. Atomic Energy Commission
Washington, D. C. 20545

Re: Docket No. 50-133
Humboldt Bay Power Plant

Dear Mr. Low:

This is in response to your letter of October 28 concerning the six-day investigation conducted by Division of Compliance personnel at our Humboldt Bay Power Plant into the allegations made by an unidentified complainant regarding difficiencies in the radiation protection procedures and practices and radiation incidents which were alleged to have occurred. Your letter indicates that of 49 separate allegations made by this complainant a total of only two items of apparent noncompliance with license requirements was found. In our opinion, both of these items involve technical aspects of the regulatory requirements rather than matters of personnel safety.

The first of the two items concerns radiation protection aspects of the entry by Plant personnel into the reactor cleanup pump area on June 21, 1970. This entry was to investigate and correct the failure of the pump's mechanical seal. We believe that the actions of Plant personnel in handling this situation were correct and proper and included adequate evaluations to assure that personnel radiation exposure for accomplishing this work was within established limits. The evaluations performed with respect to airborne concentrations of radioactive materials were qualitative in nature and relied on past experience with respect to the radionuclides found in steam resulting from a reactor coolant leak. Our interpretation of 10 CFR 20.201(b) has been that an

evaluation of the type performed was an acceptable means of complying with this regulatory requirement. As discussed below, we plan to advise Plant personnel of your interpretation that an adequate survey (evaluation) requires quantitative air sampling results under all circumstances.

The second item involves our failure to notify two former employees, who were discharged for misconduct, of their accumulated occupational radiation exposure within the 90-day period prescribed by the regulations. These former employees were promptly notified when they brought this matter to our attention. As indicated in the discussion which follows an inconsistency between the regulations and A.E.C. instructions (AEC Form 3) for implementing these regulations was involved in our misunderstanding of these requirements.

Your letter also requests that we comment on four other items identified by your inspectors in the course of their investigation. Our comments on these items are given below. Three of these items were discussed in detail with your inspectors. The fourth item, item b., has never been discussed with Company representatives and can only be commented on in a general fashion. As indicated in our discussion of these items we do not believe that any of them suggest significant deficiencies in our radiation protection program for the Plant.

A more detailed discussion of the two items set forth in the enclosure to your letter and the four items listed in your letter follows.

Item 1 of the enclosure concerning noncompliance with regulatory requirements refers to a situation which occurred early on the morning of June 21, 1970, in which three employees entered the refueling building and operated three manual valves to isolate and bypass the reactor cleanup pump following a failure of the pump's mechanical seal. This entry was for the purpose of terminating the radioactive steam and water leakage from this defective seal. You state that

> "... surveys (evaluations) were not adequate to determine compliance with 10 CFR 20.103 with respect to airborne concentrations of radioactive material to which employees were exposed on June 21, 1970 ...."

However, entry was made only after careful evaluation by a licensed Senior Control Operator and by two of the Plant's senior engineers, both of whom have Senior Operator Licenses. (The combined boiling water reactor operating experience of these three individuals totals some 34 years.) Consideration was given to making a radiation survey and collecting and analyzing an air sample in the cleanup pump area prior to entry. This course of action was not taken since it would have resulted in approximately the same exposure to the individuals doing this survey work as was required to manually isolate the pump. It was decided that since two of the three men making the entry were qualified radiation monitors they would do their own radiation dose rate monitoring. Consideration was also given to type of protective equipment to wear during the entry. The decision was made to wear normal protective clothing and half-face filter masks. This decision was based upon the fact that the Senior Control Operator had already been in the cleanup pump area wearing this equipment. A personal contamination survey, with special attention to his nostrils and mouth, showed no contamination. The filter cartridge of his face mask was, however, contaminated. This indicated that the mask had offered adequate protection. In our experience, the only significant airborne radioactivity ever seen in steam resulting from a reactor coolant leak has been 18 minute Rb-88 and 32 minute Cs-138. This is because the steam-water partition factor for the longer half life fission and corrosion products is such that these more hazardous isotypes remain in the liquid phase. With this type of steam activity nasal contamination is readily detectable long before personnel are exposed to airborne concentrations approaching the maximum permissible concentration for the mixture of short half life noble gas daughters. With steam in the atmosphere the half-face filter mask would offer much better visibility than either the full-face filter mask or the self-contained respiratory equipment. This was an important consideration because there are a number of tripping and falling hazards in the pump area. Also, half-face filter masks would not hamper the movements of the personnel isolating the pump. This was significant because the radiation field in the cleanup pump area is typically of the order of 1 to 1.5 R/hr with dose rates on piping as high as 4 to 5 R/hr. It was therefore considered important to perform the work in a minimum time to minimize radiation exposure.

In our opinion, the personnel involved used good judgment in handling this situation. None of the individuals involved in this operation received any measurable skin or

nasal contamination. An air sample taken after the entry verified that the primary airborne activity in the refueling building which had resulted from this leak was indeed Rb-88 and Cs-138, and that no significant long lived activity was present. It is also of note that inspection personnel from the Division of Compliance who reviewed this operation during a routine inspection in September 1970 did not consider it an item of noncompliance as evidenced by the fact we received no unfavorable comment or correspondence on the matter at that time.

As we interpret your letter the entry into the cleanup pump area was considered an item of noncompliance only because no air sample was taken for subsequent analysis during the time personnel were actually in the area. Based on our discussions with Compliance personnel the reason the evaluations which were made before and after this entry are not considered adequate is that no quantitative results were available even though the collection of such samples would have increased personnel radiation exposure significantly. As discussed above the qualitative evaluations which were made before and after the entry did, in our opinion, show that personnel exposure to airborne radioactivity was far below the maximum permissible concentrations for the radionuclides involved.

In response to this item we are planning a series of discussions with Plant supervisors and operating and radiation protection personnel to acquaint them with your interpretation of 10 CFR 20.201(b) as it might apply in future situations. These discussions will be completed by December 15.

Item 2 of the enclosure concerning noncompliance with regulatory requirements involves our failure to notify two former employees who were discharged for misconduct in May 1970 of their occupational radiation exposure history within 90 days as required by 10 CFR 20.408. At the time Plant management was unaware that this regulation had been revised on March 14, 1969. (Although one of the engineers on the Plant staff is assigned responsibility to review and advise Plant management of all pertinent regulatory changes this particular change was overlooked.) Plant management's impression was that the reporting requirement was as stated on AEC Form 3 "Notice To Employees" which is posted in the Plant as required by your regulations. This form has been in use for many years and states, "Your employer must give you a written report of your radiation exposure upon the termination of your employment <u>if you request</u> it." (emphasis supplied) In the situation in question these

former employees were promptly notified of their exposure histories when they brought this matter to our attention.

All Plant management personnel have been made aware of the requirements of this regulation. In the future when an individual terminates employment a written report of his radiation exposure history will be sent within the required time period. In addition the change in regulatory requirements resulting from the addition of 10 CFR 20.408 has been added to our posted AEC Form 3.

With regard to Item a. included in your letter we do not believe that there is any realistic potential for contamination of the Plant's domestic water system with reactor water via the fire protection system. In addition to multiple mechanical and hydraulic barriers which protect against such contamination a routine program of quarterly sampling and analysis of domestic water for radioactivity has been in effect for many years. There has never been any indication of contamination in the domestic water system. The results of this sampling program were discussed with your inspection personnel in considerable detail during their investigation.

The fire protection system is a source of water for one of the emergency core cooling systems, i.e., the low pressure core flooding system. This system was added to existing emergency core cooling systems in 1965. As shown in the attached figure the domestic water and fire protection system are maintained at 50 to 70 psig by means of the booster pump and hydraulic accumulator. The fire pumps normally are not in service but start automatically if pressure in the fire protection system drops below 48 psig as would be the case if the booster pump malfunctioned. The shutoff head of the fire pumps is approximately 155 psig. Since the fire loop is normally pressurized from the domestic water system any flow through the connecting double check valve crosstie between these systems is from the domestic water system. The fire pumps are routinely tested on a biweekly basis as part of the operational test program for the Unit. Leakage through the crosstie check valves would be readily detected during such tests.

During normal operating conditions with the reactor at pressure the shutdown system up to the normally closed butterfly valve (BV-4435) is at atmospheric pressure and filled with treated distilled water. It would require leakage through a series of at least three valves (as an example M06103, M06112, and BV4435) and pressurization of the shutdown system to allow reactor water to

reach the Plant fire protection system. In addition to these multiple barriers a leak detection system is provided to sense and indicate the leakage of reactor water into the shutdown system through either the suction or discharge isolation valves. In addition shutdown system pressure indication would warn of leakage from the reactor into the shutdown system.

When the reactor is shut down there are again multiple valve barriers to prevent reactor water from reaching the fire protection system. It would require the simultaneous leakage of butterfly valve BV4435 and the manual valve downstream of the butterfly valve to provide such a path. In addition the pressure in the shutdown system is substantially less than that in the fire protection system under normal shutdown conditions with the reactor vessel head removed. Additional assurance that flow does not occur from the shutdown system to the fire protection water system is provided by a drain valve (telltale) between BV4435 and the manual valve. When the reactor is shut down the manual valve can be closed as soon as the reactor pressure is less than 150 psig. The telltale valve between the butterfly and manual valve can then be opened to provide positive assurance against leakage. The shutdown system isolation valves cannot be opened until reactor pressure is less than 120 psig. (This interlock system is described in IV.A.2. of the Technical Specifications.)

To provide added assurance that no leakage can occur between the shutdown system and the fire protection system when the reactor is shut down operating procedures for reactor shutdown will be modified to require that the butterfly valve BV4435 be deactivated in the closed position, the manual valve closed, and the telltale valve opened before the shutdown system is activated. It is expected that these modifications to operating procedures will be completed and ready for use by December 15.

In our opinion, the physical barriers described above, supplemented by the routine sampling of domestic water, provide adequate assurance against contamination of the Plant's fire protection and domestic water systems under all normal operating conditions. Actuation of the low pressure core flooding system in response to a loss of coolant accident signal in conjunction with reactor pressure of 150 psig or less does result in automatic opening of the valves connecting the fire protection system to the reactor (BV4435, M0V6112, and M0V6103). This same signal starts all three fire pumps. During the two second period while the fire pumps are coming up to speed the pressure downstream of valve BV4435 is greater than the upstream pressure. The average

reverse differential during this time interval is 50 psi. The crosstie between the fire system and the domestic water system consists of a 1-inch line containing a flow restricting orifice and two check valves. In our opinion it is completely unrealistic to assume that the contained volume of solid water between the shutdown system and domestic water system (approximately 460 gallons) could be displaced by reactor water since this would require a check valve leakage rate greater than 13,000 gpm. If one assumes any reasonable check valve leakage rate the small amount of backflow which could occur through valve BV4435 would be flushed back into the shutdown system as soon as the fire pumps develop full pressure and the pressure upstream of valve BV4435 exceeds the pressure downstream. Therefore, while the potential exists for temporary contamination of a small section of the fire protection system for a few seconds during operation of the low pressure core flooding system, it is not possible for this contamination to reach the domestic water system. The only actual operation of the low pressure core flooding system in the history of the Plant occurred on July 17, 1970, as a result of a spurious actuation of the system. As a means of further verification, operating procedures have been established requiring that domestic water samples be taken after any activation of the low pressure core flooding system. It is expected that these procedures will be completed and ready for use by December 15.

Regarding item b. it is not possible for us to comment specifically since this item has never been discussed with Company representatives. Training programs do exist for all classifications of Plant personnel who perform safety related work. These training programs are designed to be commensurate with the nature of the work performed by a given classification and the level of supervision and radiation monitoring provided for the work.

We are not aware of the occasion described in your example where

> "... fuel handling operations were conducted by an operator who had not been trained adequately with respect to the radiation hazards associated with these operations."

Our objective in operator training programs has always been to take the necessary steps to assure that all operators involved in fuel handling operations are fully trained in

radiation protection practices. This training for new operating employees includes both formal training in the Company's Radiation Control Standards and the Radiation Control Procedures which implement these Standards and on-the-job training during actual fuel handling operations as part of a crew which includes experienced AEC licensed reactor operators. All new operators are in training for an AEC reactor operator's license and are examined by the AEC in their knowledge of radiation protection as a part of this examination. In the eight years of operation of the Unit there has never been a radiation incident resulting in abnormal exposure to Plant personnel which would suggest any weakness in these training programs.

Item c. concerns Radiation Work Procedure (RWP) forms, which authorize personnel to perform specific jobs of a routine nature in areas where radiological conditions will normally remain unchanged. RWPs are usually valid for an extended period. There are no AEC requirements that such forms be used in carrying out radiation work. Rather, these forms are a part of the administrative controls for radiation work which are covered in the Company's Radiation Control Procedures. A copy of the procedure relating to these forms and a sample of a RWP form is attached. RWP forms are initiated by the Plant Radiation Protection Engineer and signed by the Plant Superintendent and by all first line level operations and maintenance supervision.

Your comments specifically concern that portion of the form dealing with expected radiation conditions in the work area. Our practice since initial Plant operation has been to apply judgment in following the instructions for preparing these forms. For example, when radiation conditions are subject to change the form is normally completed by stating that radiation conditions are "variable." This provides warning to personnel that careful monitoring is required and is fully consistent with the intent of 4e. and f. of the attached procedure for these forms. One exception has been the RWP form for the radiochemical laboratory. The radiation conditions section has been left blank on the basis that radiation conditions are variable and that this work is always performed by radiation monitoring technicians who are trained to perform their own monitoring.

The practices described above have been in use since initial Plant operation in 1963 without criticism from the AEC

Division of Compliance. However, in order to avoid further controversy in this matter instructions 4e. and f. for completing RWP forms will be revised as follows:

"e. Monitoring Requirements

The Radiation Protection Engineer will specify the appropriate monitoring requirements for the work performed under the RWP. The following selections are provided for on the RWP form:

1. Continuous by R.P. (Radiation Protection personnel)

2. By R.P. as required (i.e., start of job) - details to be specified on RWP.

3. By individuals doing work.

4. Other - details to be specified.

f. Radiation Conditions

Space is provided on the RWP form for specifying the radiation levels which may be encountered in the areas covered by the RWP. In locations where radiation levels may be variable due to the nature of the work being performed this will be noted on the RWP and special caution is to be exercised by individuals in the course of performing work in these areas. In locations where radiation levels are expected to remain constant these levels will be entered on the RWP. In the event that actual conditions exceed the levels indicated on the RWP the RWP is no longer valid. Radiation conditions must be reestablished and monitoring requirements reevaluated prior to proceeding with work under these circumstances."

This revision is expected to be completed and in use by December 15.

Item d. concerns an occurrence involving a former employee which took place on May 12, 1970. This individual, who was a plant Control Technician at that time, requested permission to discuss a number of items which he considered

safety matters with Mr. R. T. Dodds, A.E.C. Division of Compliance Reactor Inspector, who was in the Plant conducting a routine inspection. After a detailed discussion of these matters with the individual Plant management denied his request for time off the job with pay to see Mr. Dodds. It was made clear to the individual he was free to speak to Mr. Dodds after working hours and that Mr. Dodds was staying in town that night. The individual was "discouraged" from talking to Mr. Dodds only in the sense that he was advised to attempt to resolve matters of this kind with Plant supervisors before discussing them with the AEC. The individual indicated that he was generally satisfied regarding these matters at the end of this discussion. Mr. Dodds was told about this conversation by Plant management on the day on which it occurred.

Our position is that this matter was handled in a manner fully consistent with the language of AEC Form 3 "Notice to Employees" which states:

> "Inquiries dealing with matters outlined above (standards for protection against radiation) can be sent to the United States Atomic Energy Commission Compliance Office having inspection responsibility over your plant."

If an employee feels that he has a significant item concerning radiation safety which he would like to discuss with an AEC representative, he clearly has the means of doing so. The AEC Form 3 gives the phone number and mailing address of each regional AEC office. The incident discussed above is the only occurrence of this type in the history of the Plant.

If you wish any further information regarding any of these matters please let me know.

Sincerely,

Philip A. Crane, Jr.

cc: Director, Division of Compliance
Region V
U. S. Atomic Energy Commission
2111 Bancroft Way
Berkeley, California

19-143P
Rev. 11/70

PACIFIC GAS AND ELECTRIC COMPANY
RADIATION WORK PROCEDURE

PLANT: AREA(S) RWP NO. REV.

VALID: FROM TO

Description of Work:

Special Hazards:

Monitoring Requirements - Specify Details

1. Continuous by R.P.
2. By R.P. as required (i.e. start of job)
3. By Individual doing Work
4. Others

Maximum Radiation Conditions for Work

Location	mRem/hr	cps/sq.ft.	μCi/cc

General Instructions

1. Obtain permission of Shift Foreman before entry to controlled area.
2. Obtain protection for cuts or abrasions from RP before start of job.
3. In case of injury or change of work conditions, immediately notify RP and/or Shift Foreman.
4. Monitor tools and equipment at completion of job.
5. Make personnel survey before crossing access control station step-off pad. Remove bags, booties, and/or rubber shoe covers before stepping on step-off pad at access control.
6. Take hand & foot count after leaving access control station.
7. Enter exposure on exposure card at the end of the day.

Protective Equipment Requirements

Head	☐	Surgeon's Cap
	☐	Hood - Canvas
	☐	Face Shield
	☐	Goggles
	☐	Hood - Waterproof
Body	☐	Lab Coat
	☐	One Coveralls
	☐	Two Coveralls
	☐	No Personal Clothing
Hands	☐	Gloves - Surgeon's
	☐	Handguards
	☐	Gloves - Heavy
Feet	☐	Rubbers
	☐	Booties - Canvas
	☐	Plas. Bgs. (over Booties)
Resp.	☐	Full Face Filter
	☐	Half Face Filter
	☐	Chemox/Fresh Air
Dosimetry	☐	Film Badge
	☐	Gamma Pencils
	☐	Neutron Film
	☐	Finger Film
	☐	GM
	☐	CP
	☐	Special Instruction

Special Instructions (Continued on other side)

Approved by: Plant Supt. - Rad. Prot. Engr. -

Operations	Maintenance	Technical

1. RWP's will normally be prepared by the Radiation Protection Supervisor. The signature of the Plant Superintendent and the Radiation Protection Supervisor are required to establish the RWP.

2. Each supervisor in the Plant will read and initial each RWP.

3. The Shift Foreman will be responsible for the control of Controlled Area entries made under provisions of the RWP, and for maintaining compliance with the provisions of the procedures.

4. Each RWP will contain the following information:

   a. Area - A detailed description of the work location.

   B. RWP NO. - This contains the serial number issued by the Radiation Protection Supervisor.

   c. Date - The time period for which the RWP is valid.

   d. Description of Work - The Radiation Protection Supervisor will describe in concise terms the nature of the work to be performed under the provisions of the procedure including any special hazards that may be encountered.

   e. Monitoring Requirements - In this block, space is provided for specifying monitoring requirements. In those instances where the radiation levels are likely to change during the course of the job, continuous monitoring should be provided. Where it is reasonably certain that the radiation levels will remain constant for the entire duration of the work, conditions will be determined by radiation protection personnel and dosage rates established on the RWP.

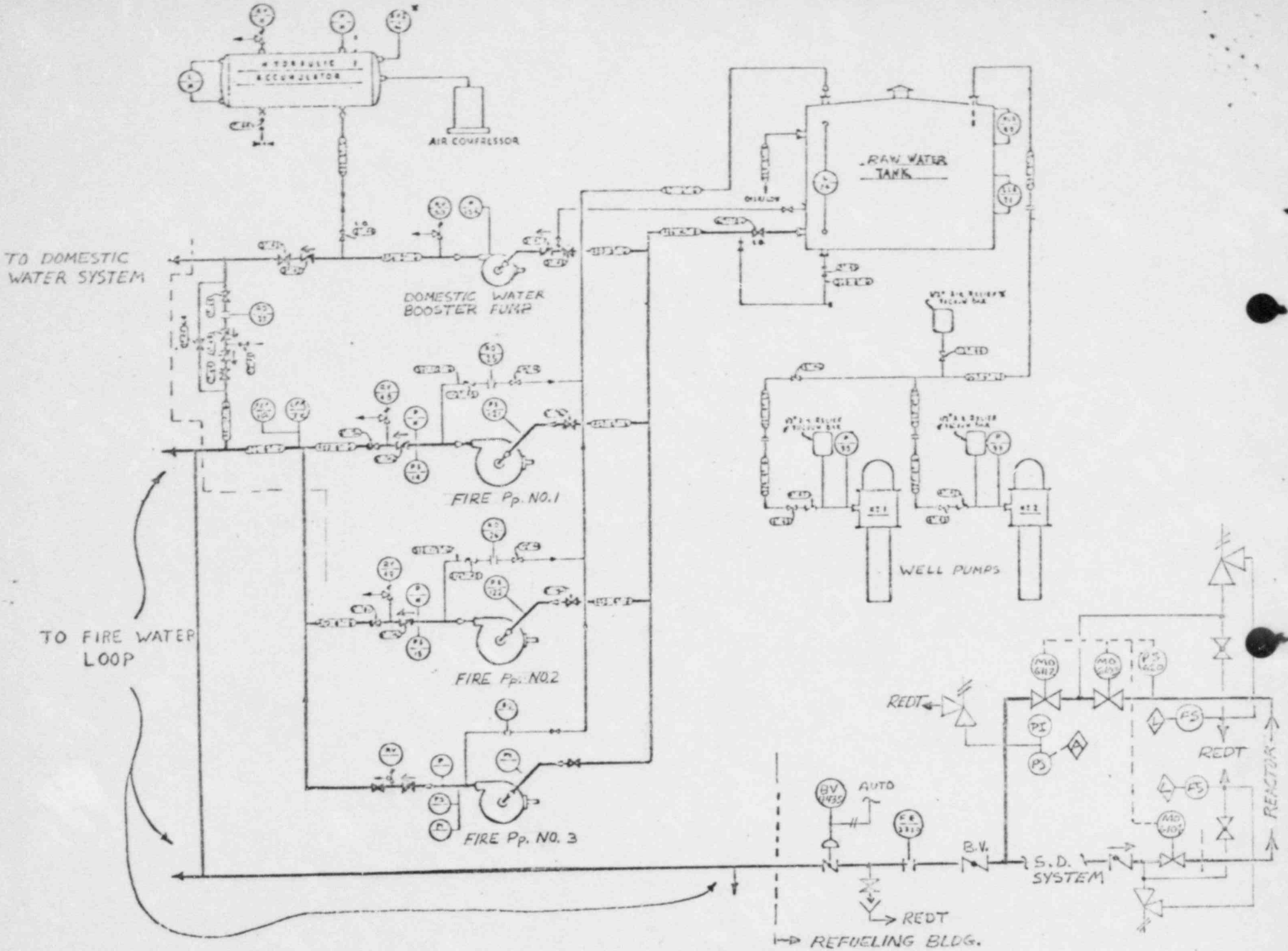
   f. Maximum Radiation Condition - In this block, space is provided for five different areas in which different radiation levels may be encountered in the course of performing the described work. The dose rate and the critical organ will be specified for each area.

   g. General Instructions - This is a list of general instructions for conduct during the performance of work, and at the completion of the job.

   h. Protective Equipment Requirements - The required protective clothing, equipment, personnel monitors and special precautions will be specified.

   i. Special Instructions - The precautions to be taken by the persons performing the work described on the RWP.

5. All RWP's will be kept available to all personnel at the Radiation Zone Status Board. Since the RWP's are subject to revision, each person performing work under one will read and understand its provisions before entering the Controlled Area and shall comply with its provisions in all respects.



DOMESTIC, FIRE & RAW WATER SYSTEMS