

February 24, 1960

ATOMIC ENERGY COMMISSION
DIVISION OF LICENSING AND REGULATION
REPORT TO ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
ON
PEACH BOTTOM SITE



Note by Director, Division of Licensing and Regulation

The attached report has been prepared by the Staff of the
Division of Licensing and Regulation for consideration by the
Advisory Committee at its March meeting.

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PEACH BOTTOM SITE

The Philadelphia Electric Company proposes to construct a 115 Mw (thermal) nuclear power station on the Conowingo Pond of the Susquehanna River in York County, Pennsylvania. The plant will be owned and operated by the Philadelphia Electric Company. Bechtel Corporation is the prime contractor, and General Atomic is subcontractor for the nuclear components of the plant. In addition, General Atomic has a contract with the AEC to perform necessary research and development in support of the design. It is anticipated that construction will commence in the Spring of 1961, with completion scheduled for December 1963.

The applicant has requested a review of the site prior to submittal of a formal application for construction permit which will include the preliminary hazards report. This request was supported by a Site Evaluation Report, copies of which have been forwarded to the ACRS. The site report includes a detailed discussion of the site and environmental characteristics, and a conceptual description of the plant.

Site Description

The proposed plant will be located on the westerly shore of Conowingo Pond, in Peach Bottom Township. Conowingo Pond is formed by the backwater of the Conowingo Dam on the Susquehanna River; the dam is located about six miles south of the Pennsylvania-Maryland border. The pond extends upstream about 15 miles to the Holtwood Dam. It varies in width from 0.6 to 1.5 miles and contains, when full, 240,000 acre feet or 80 billion gallons of water. The top ten feet (80,000 acre feet) is used at pondage to generate power at the 252 Mw Conowingo hydroelectric plant. The observed flows of the river have ranged from a minimum of 1450 sec-ft (1930-32) to a maximum of 875,000 sec-ft (1936). The mean flow is 36, 200 sec-ft.

The site consists of 600 acres owned by the Philadelphia Electric Co. and situated about nine miles upstream from the Conowingo Dam. The reactor will be located about 125 feet from the shoreline. The minimum exclusion distance on the west side of pond is 3000 feet. The pond to the east is about 7600 feet wide. The terrain immediately surrounding the plant location is moderately wooded and slopes toward the pond. Within a mile of the plant steep hills rise to an elevation about 300 feet above plant grade level.

The population distribution in the vicinity of the Peach Bottom site is summarized as follows:

	<u>Pop.</u>	<u>Census date</u>	<u>Est. 1969</u>
Within 3000 feet	0		
Within 1 mile	120	1959	50
Within 5 miles	5,700	1959	7,100
Within 10 miles	25,000	1959	31,000
Within 25 miles	385,700	1950	
Within 50 miles	2,934,000	1950	

Significant population centers within a 10 mile radius of the site include the following:

	<u>Pop.</u>	<u>Dist.</u>	<u>Direction</u>
State Hill:	50	1.7 miles	SW
Peach Bottom:	70	2,3	E
Delta, Cardiff	1590	4	SW

At present the river below Peach Bottom is the sole source of water for the City of Havre de Grace (pop. 8000), the Perry Point Veterans Hospital, and the Bainbridge Naval Training Station, which supplies the town of Point Deposit. A total of 856 million gallons of water were withdrawn below Conowingo

Dam in 1958. The City of Baltimore is currently constructing a pipeline that will intake from a point about one quarter of a mile above the dam. This system is scheduled for completion in the mid 1960's.

In the general area of the site the prevailing wind is south of west in the summer and north of west in the winter. The most frequent wind direction is west, occurring 17%; the least frequent is southeast, occurring about 8%. Calms occur about 7% of the time. In the immediate vicinity, the river valley produces a channeling influence up and down stream. Throughout the year down-channel winds occur 47% and up-channel winds 43% of the time. Winds at an appreciable angle to the channel occur only 7% of the time.

Facility Description

At the present date, only conceptual design information is available concerning the Peach Bottom plant. The reactor will be a high temperature, helium cooled, graphite moderated, type producing 115 thermal Mw (40 electrical Mw). The fuel elements, which also function as a portion of the moderator, consist of fully enriched uranium and thorium carbides homogeneously dispersed in graphite. The helium is circulated through two external coolant loops, one of which also serves as an emergency cooling system. The design goal for the gas conditions is 1380 F at 300 psi, with steam conditions of 1000 F at 1450 psi.

The ultimate fuel element design incorporates a cladding of dense graphite. In event such an element cannot be developed, it is proposed to substitute stainless steel clad elements, which would allow a helium temperature of 1015 F and steam conditions of 850 F and 850 psi. The graphite clad fuel elements require a fission product trapping system to limit the level of fission product contamination of the primary system. Fission products which diffuse from the fuel material (roughly 50 percent) will be trapped in relatively cool (660F) extensions

of each fuel element and in an external water cooled adsorption system.

Containment is proposed to enclose all normally radioactive systems, including the primary cooling system, fission product traps, spent fuel storage pool, fuel handling system, and helium dump tank. The design pressure of the containment vessel is not yet specified, but the structure will be designed in accordance with existing Codes to contain pressures resulting from the maximum credible accident to the reactor. The anticipated leak rate is 0.05% per day at the design pressure. The containment structure will be a welded vertical cylindrical tank with conforming end enclosures.

Discussion

With respect to exclusion area and surrounding population density, the Peach Bottom site is considered to compare favorably with other power reactor sites, and definitely appears adequate for a gas cooled reactor of this capacity. However, there is one factor regarding the site that requires careful attention - its location on the Conowingo Pond of the Susquehanna River. Therefore, it appears that acceptance of this site essentially depends on satisfactory resolution of the following matters: (1) the ability of the facility to protect the pond water from contamination, (2) the maximum extent of contamination of the pond water resulting from any normal or abnormal releases, (3) the consequences involved should the pond become contaminated, and (4) possible measures to reduce the hazard in event of a release to the pond.

On the basis of information contained in the Site Evaluation Report, the applicant has not provided documented assurance that these problems have been resolved. However, in discussions with the ACRS Subcommittee and Staff (2/17/60) the applicant satisfactorily answered a number of pertinent questions and agreed to furnish additional written material relating to the problem of safeguarding of the pond water. The staff believes that this additional information will support acceptability of the site.

The applicant has discussed the consequences of a hypothetical maximum credible accident, considered to be a major rupture of the primary coolant system and complete loss of helium pressure. At this stage of design it is difficult to predict the effect of such an incident on the reactor core, but the applicant has assumed that the metal clad type of fuel elements would fail. The additional assumption is made that 100% of the noble gases, 100% of the halogens, and 20% of all other fission products are released to the containment volume. The Staff believes that this probably represents an upper limit for any release of activity from a reactor of this type.

On the basis of the above described accident, dosages have been calculated for several types of exposures: gamma shine, whole body cloud gamma, inhalation to thyroid, lung beta, and strontium-90 inhalation. It appears that these doses are within acceptable limits, except those for close range direct shine from the containment vessel. For example, at the pond shore (150 feet) the dose rate at 10 minutes following the accident is 1500 r/hr and the integrated dose for the first 10 minutes is 270 r. It therefore may be necessary to provide shielding of the containment structure. However, further discussion of this matter can be appropriately deferred until the construction permit review (expected in July 1960). The applicant has provided supplementary data indicating that the activity at the proposed Baltimore water intake resulting from this accident would not exceed AEC permissible tolerances for any single isotope.

The Staff believes that the probability for releases of activity to the containment is higher than normal for this facility. This is due to the lack of fission product retention within the fuel elements and their consequent accumulation in the external traps and primary coolant. It therefore is apparent that relatively greater reliance need be placed on the integrity of

this containment structure than on others considered to date. The Staff believes that the problem can be appropriately resolved by a rigid review of the containment specifications.

Additional Staff effort is required concerning possible liquid releases to the pond, since it appears that relatively small discharges could contaminate the water beyond tolerance levels. The applicant has been requested to give further consideration to the various inventories of activated material to be stored on the site and the consequences of accidental release of such material to the water. However, inasmuch as all activated material will be retained within the containment (except during transfer off-site), the Staff believes that this problem can be adequately resolved by proper design, techniques and procedures.

Conclusions

The Staff considers the Peach Bottom site suitable for construction of the proposed gas cooled power reactor. However, the design of the facility must afford sufficient safeguards against contamination of the adjacent Conowingo Pond, a major source of potable water. The design plans to date appear to give sufficient consideration to this matter.

The comments of the Committee are solicited regarding two matters: (1) the acceptability of the site for a reactor of this general type and power level, and (2) any specific items of information which should be included in the forthcoming preliminary hazards report.