

JUN 07 1988

NOTE TO: R Nataraja  
FROM: Ron Ballard  
SUBJECT: OVERFLIGHT RESTRICTIONS AT NUCLEAR FACILITIES

Ralph Stern of DOE wishes to discuss with NRC our posture on overflight restrictions at nuclear facilities. J. Youngblood asked us to follow up on the NRR licensing experience, in preparation for informal discussion with DOE. The assignment to collect background information is placed placed with your section.

As an assist in obtaining the needed background material, I suggest that you first contact <sup>Brian 9E-3</sup> B. Grimes, Deputy Director of DRIS (X-20969) who has a couple of old files related to arrangements made with the US Air Force on overflights in the vicinity of nuclear power plants. Also, a call to <sup>10E-5</sup> Kaz Campe of NRR (X-21092), who participated in such evaluations, may prove helpful (The NRR Standard Review Plan also provides guidance on overflight evaluation.) Another possible lead is Bob Bernett, regarding Safeguards aspects. I believe special arrangements have been made in the past with both the Military and FAA to avoid overflight interference with nuclear facilities.

This effort should involve at most a few hours of effort to gather the readily available background information on overflights. The target date for the summary is Friday, June 10, 1988.

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x 23365

Elizabeth  
Ten Tek

*Ron Ballard*  
Ron Ballard

cc: J. Youngblood

Bob Erikson  
20933

*John Buckley*

*you are assigned to  
gather the necessary info.  
Please keep me and Dinesh  
informed on what you  
find out. Raj 7/7*



U.S. NUCLEAR REGULATORY COMMISSION  
**STANDARD REVIEW PLAN**  
OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 3.5.1.6

AIRCRAFT HAZARDS

REVIEW RESPONSIBILITIES

Primary - Accident Analysis Branch (AAB)

Secondary - Structural Engineering Branch (SEB)  
Auxiliary and Power Conversion Systems Branch (APCSB)I. AREAS OF REVIEW

The staff reviews the applicant's assessment of aircraft hazards to the plant. The purpose of the review is to assure that either aircraft hazards are eliminated as a design basis concern or appropriate design basis aircraft have been chosen and properly characterized as to impact and fire hazards. The review also involves a determination of adequate protection against fire hazards for design basis events. Some information relating to this review is contained in Section 2.2 of the applicant's safety analysis report (SAR), e.g., facility locations, projected traffic, and accident statistics.

The APCSB determines which structures and components are to be protected, and the SEB assures that adequate protection has been provided.

II. ACCEPTANCE CRITERIA

1. The plant is considered adequately designed against aircraft hazards if the probability of aircraft accidents resulting in radiological consequences greater than 10 CFR Part 100 exposure guidelines is less than about  $10^{-7}$  per year (see Standard Review Plan 2.2.3).
2. The probability is generally considered acceptable by inspection if the level of aircraft activity near the site falls below the criteria given in Section 2.2.3 of Regulatory Guide 1.70 (Ref. 2) for analysis of hazards due to commercial, experimental, and general aviation aircraft. For military airspace, a minimum distance of five miles from the reactor is adequate for low level training routes except those associated with usage greater than 1000 flights per year or activities (such as practice bombing) where an unusual stress situation exists.
3. Aircraft accidents which could lead to radiological consequences in excess of the exposure guidelines of 10 CFR Part 100 with a probability of occurrence greater than about  $10^{-7}$  per year should be considered in the design of the plant.

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**USNRC STANDARD REVIEW PLAN**

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to Revision 2 of the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

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4. The evaluation of fire hazards will be done on an individual case basis. Concrete structures are generally assumed to withstand fire, but protection must be provided to prevent fire, smoke, or flammable mixtures from entering safety-related ventilation intakes, such as those for the control room, areas housing shutdown equipment, and the diesel generators.

### III. REVIEW PROCEDURES

The reviewer selects and emphasizes aspects of the areas covered by this review plan as may be appropriate for a particular case. The judgment on areas to be given attention and emphasis in the review is based on an inspection of the material presented to see whether it is similar to that recently reviewed on other plants and whether items of special safety significance are involved.

The staff's review of the aircraft hazard assessment consists of the following steps:

1. Data describing aviation uses in the airspace near the proposed site, including airports and their approach paths, federal airways, Federal Aviation Administration (FAA) restricted areas, and military uses is obtained from Section 2.2 of the SAR. For many cases, no detailed analysis need be made as the probability can be judged adequately low based on a comparison with analyses previously performed. In such cases the conclusion reached and a citation of the cases used for comparison should be transmitted by buck slip to the AAB site analyst for retention in the case workbook.
2. For situations where federal airways or aviation corridors pass through the vicinity of the site, the probability per year of an aircraft crashing into the plant ( $P_{FA}$ ) should be estimated. This probability will depend on a number of factors such as the altitude and frequency of the flights, the width of the corridor, and the corresponding distribution of past accidents.

One way of calculating  $P_{FA}$  is by using the following expression:

$$P_{FA} = C \times N \times A / w$$

where:

C = inflight crash rate per mile for aircraft using airway,

w = width of airway (plus twice the distance from the airway edge to the site when the site is outside the airway) in miles,

N = number of flights per year along the airway, and

A = effective area of plant in square miles.

This gives a conservative upper bound on aircraft impact probability if care is taken in using values for the individual factors that are meaningful and conservative. For

commercial aircraft a value of  $C = 3 \times 10^{-9}$  per aircraft mile has been used. For heavily traveled corridors (greater than 100 flights per day), a more detailed analysis may be required to obtain a proper value for this factor.

3. The probability of an aircraft crashing into the site should be estimated for cases where either of the following apply:
  - a. An airport is located within five miles of the site.
  - b. An airport with projected operations greater than 500  $d^2$  movements per year is located within ten miles of the site, or an airport with projected operations greater than 1000  $d^2$  movements per year is located beyond ten miles from the site, where "d" is the distance in miles from the site.

The probability per year of an aircraft crashing into the site for these cases ( $P_A$ ) may be calculated by using the following expression:

$$P_A = \sum_{i=1}^L \sum_{j=1}^M C_j N_{ij} A_j$$

where:

M = number of different types of aircraft using the airport,

L = number of flight paths affecting the site,

$C_j$  = probability per square mile of a crash per aircraft movement, for the jth aircraft,

$N_{ij}$  = number (per year) of movements by the jth aircraft along the ith flight path, and

$A_j$  = effective plant area (in square miles) for the jth aircraft.

As noted earlier, the choice of values for the parameters should be made judiciously in order to arrive at a meaningful result. The manner of interpreting the individual factors may vary on a case-by-case basis because of the specific conditions of each case or because of changes in aircraft accident statistics.

Values for  $C_j$  currently being used are taken from the data summarized in the following table:

Distance From End of Runway (miles)	Probability ( $\times 10^8$ ) of a Fatal Crash per Square Mile for Aircraft Movements			
	U.S. Air Carrier <sup>1</sup>	General Aviation <sup>2</sup>	USN/USMC <sup>1</sup>	USAF <sup>1</sup>
0-1	16.7	84	8.3	5.7
1-2	4.0	15	1.1	2.3
2-3	0.96	6.2	0.33	1.1
3-4	0.68	3.8	0.31	0.42
4-5	0.27	1.2	0.20	0.40
5-6	0	NA <sup>3</sup>	NA	NA
6-7	0	NA	NA	NA
7-8	0	NA	NA	NA
8-9	0.14	NA	NA	NA
9-10	0.12	NA	NA	NA

<sup>1</sup> Reference 2.

<sup>2</sup> Reference 4.

<sup>3</sup> NA indicates that data was not available for this distance.

- For military installations or any other airspace usages, a detailed quantitative modeling of all operations should be verified. The result of the model should be the total probability (C) of an aircraft crash per unit area and time in the vicinity of the proposed site.

The probability per year of a potentially damaging crash at the site due to operations at the facility under consideration ( $P_M$ ) is then given for this case by the following expression:

$$P_M = C \times A$$

where:

C = total probability of an aircraft crash per square mile per year in the vicinity of the site, and

A = effective area of the plant in square miles.

- The total aircraft hazard probability at the site equals the sum of the individual probabilities obtained in the preceding steps.
- The effective plant areas used in the calculations should include the following:
  - A shadow area of the plant elevation upon the horizontal plane based on the assumed crash angle for the different kinds of aircraft and failure modes.

- b. A skid area around the plant as determined by the characteristics of the aircraft under consideration. Artificial berms or any other man-made and natural barriers should be taken into account in calculating this area.
- c. Areas of the plant susceptible to structural damage as a result of aircraft impact.
- d. Areas of the plant susceptible to fire hazards resulting from aircraft accidents on the site.

For those classes of aircraft hazard having a probability of occurrence of causing radiological consequences in excess of 10 CFR Part 100 guidelines greater than about  $10^{-7}$  per year, the reviewer should verify that the proper design basis events have been chosen and the aircraft properly characterized in terms of impact and fire parameters.

The capability of structures to withstand the postulated aircraft impacts will be reviewed by the SEB, and the vital target areas will be defined by the APCSB. In the past, external fire effects have been evaluated by the AAB with assistance from consultants (Ref. 3), but the APCSB will review this area for future applications.

#### IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and drafts an introductory paragraph for the evaluation findings indicating those facilities described in SAR Section 2.2 for which an aircraft hazards analysis was performed. A brief description of the methods used in the analysis should be provided, together with references to any sources of statistical data utilized.

The reviewer also verifies that the review and calculations support conclusions of the following type, to be included in the staff's safety evaluation report:

1. "The applicant's assessment of aircraft hazards at the site has been independently verified by the staff and results in a probability less than about  $10^{-7}$  per year of an accident having radiological consequences worse than the exposure guidelines of 10 CFR Part 100. We conclude, therefore, that operation of the \_\_\_\_\_ plant in the vicinity of \_\_\_\_\_ does not present an undue risk to the health and safety of the public."
2. "Plant sites reviewed in the past which had equivalent aircraft traffic in equal or closer proximity were, after careful examination, found to present no undue risk to the safe operation of those plants. Based upon this experience, in the staff's judgment, no undue risk is present from aircraft hazard at the plant site now under consideration."
3. "The applicant's assessment of aircraft hazards at the site has been independently verified by the staff and we corroborate that if the plant (or appropriate parts of

the plant) is designed to withstand the aircraft selected as the design basis aircraft, the probability of an aircraft strike causing radiological consequences in excess of the exposure guidelines of 10 CFR Part 100 is less than about  $10^{-7}$  per year. We conclude, therefore, that the operation of the \_\_\_\_\_ plant in the vicinity of \_\_\_\_\_ does not present an undue risk to the health and safety of the public."

V. REFERENCES

1. 10 CFR Part 100, "Reactor Site Criteria."
2. D. G. Eisenhut, "Reactor Siting in the Vicinity of Airfields." Paper presented at the American Nuclear Society Annual Meeting, June 1973.
3. I. I. Pinkel, "Appraisal of Fire Effects from Aircraft Crash at Zion Power Reactor Facility," July 17, 1972 (Docket No. 50-295).
4. D. G. Eisenhut, "Testimony on Zion/Waukegan Airport Interaction" (Docket No. 50-295).
5. USAEC Regulatory Staff, "Safety Evaluation Report," Appendix A, "Probability of an Aircraft Crash at the Shoreham Site" (Docket No. 50-322).
6. "Addendum to the Safety Evaluation by the Division of Reactor Licensing, USAEC, in the Matter of Metropolitan Edison Company (Three Mile Island Nuclear Station Unit 1, Dauphin County, Pennsylvania)," April 26, 1968 (Docket No. 50-289).
7. Letter to Honorable J. R. Schlesinger from S. H. Bush, Chairman, Advisory Committee on Reactor Safeguards, "Report on Rome Point Nuclear Generating Station," November 18, 1971 (Project No. 455).
8. Letter to Mr. Joseph L. Williams, Portland General Electric Company, from R. C. DeYoung (in reference to Mr. Williams' letter of May 7, 1973), November 23, 1973 (Project No. 485).
9. "Aircraft Considerations-Preapplication Site Review by the Directorate of Licensing, USAEC, in the Matter of Portland General Electric Company, Boardman Nuclear Plant, Boardman, Oregon," October 12, 1973 (Project No. 485).
10. Letter to Mr. J. H. Campbell, Consumers Power Company, from Col. James M. Campbell, Dep. Chief, Strategic Division, Directorate of Operations, U. S. Air Force, May 19, 1971 (Docket No. 50-155).

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6-3

Section 6.2.1.1.2, Data Relevant to the Evaluation, Page 6-9, Paragraph 6

This section provides information on the jurisdiction and control of all land parcels relevant to the Yucca Mountain Site. This includes the Nevada Test Site segment, Nellis Air Force Range segment and the Bureau of Land Management segment. The section indicates that all these lands are currently free and clear of encumbrances arising under lease, right of entry, deed, patent, mortgage, appropriation, prescription, or otherwise (page 6-9, paragraph 5) although the DOE only has control of the NTS segment. However, in paragraph 6 within the discussion on assumptions and data uncertainties it is stated that although the DOE has control over water rights from points of extraction on the NTS, it is possible that superior rights to the water in the same underground source may exist with respect to some point of extraction outside the NTS boundaries. It is also stated that the significance of this issue would depend on superior rights, as well as on a comparison of the amount of water needed to construct and operate the repository to the amount available for extraction from the underground source. This particular discussion of possible superior rights to the water in areas outside the NTS boundaries appears to imply that water rights on repository site segments other than NTS could be held by non-governmental entities. This would not be consistent with other statements in the draft EA and should be clarified.

6-4

Section 6.2.1.4.2, Data Relevant to the Evaluation, Assumptions and Data Uncertainties, Page 6-27, Paragraph 3

This paragraph provides data relevant to the evaluation of the qualifying condition of the guideline on meteorology (10 CFR 960.5-2-3). As stated, much of the meteorological data is not site specific to Yucca Mountain. The assumption is made that monitoring stations with long-term records (Yucca Flat and Beatty) are representative of conditions at the Yucca Mountain repository. There is no evidence of an attempt to validate, correlate, or compare the most recently compiled meteorological data at Yucca Mountain with the long-term monitoring stations.

6-5

Section, 6.2.1.5.4, Potentially Adverse Conditions (1), Pages 6-37 to 6-40, Paragraphs All

The draft EA does not adequately discuss the potential effects of some of the present and future defense-related activities in the vicinity of the proposed site on the design, construction, operation and closure of the proposed repository facilities. Since the Yucca Mountain site is partly located on the

Nellis Air Force Range, the possible effects of vibratory ground motion and pressure waves resulting from "practice bombing" in the vicinity of the site should be considered in the design. In the draft EA, there is no mention of the conceivable consequences from misfired armament on board the aircraft in the event of flight or bombing errors. More information would be needed about the specific type of bombs or other armament on board the aircraft, or used at the range, in order to make a determination of the potential danger these overflights might have on the repository. It is suggested that the final EA also address the measures taken to avoid direct bomb hits on geologic repository surface facilities during the operating life of the repository. The effects of any design changes due to the above mentioned considerations on the environmental impacts should be evaluated and described in the final EA.

6-6

Section 6.2.1.5.4, Potentially Adverse Conditions (1), Pages 6-37 through 6-40

A portion of the Yucca Mountain site is proposed to be located on the Nellis Air Force Range. As shown in Table 5-27 on page 5-60 of the draft EA and in Table 16 of the report by Jackson et al. (1984), a potential aircraft crash appears to be the accident scenario leading to maximum population whole-body dose commitments ( $< 1.1 \times 10^2$  man-rem) as compared to those from other postulated accidents. The draft EA states (page 6-37, paragraph 3) that for the military - aircraft flights to and from target areas, the probability of an airplane crash at the repository site has been estimated at less than  $2.0 \times 10^{-10}$  per year. The basis for this conclusion has not been sufficiently substantiated in the draft EA.

On pages 63 to 66 of the Jackson et al. (1984) report, typical calculations for aircraft crash probability are given. The aircraft crash probability is calculated for a very small area ( $4 \times 4.9 \times 2.9$ m) of the repository surface facilities which would contain an estimated four hot cells. Because a typical plane crash is likely to affect a much larger area due to its sliding along the ground upon impact, fire and flying debris, a much larger area should be considered for the aircraft crash probability calculations.

Also, in the last paragraph of page 65 (Jackson et al., 1984) the potential impact of many factors are not taken into account for probability calculations, but have been assumed to be negligible. It is recommended that the DOE further review its aircraft crash probability calculations, revise them by making more realistic assumptions, and evaluate and discuss their environmental consequences in the final EA.

UNITED STATES GOVERNMENT

# Memorandum

TO : Maj. Gen. A. W. Betts, Director  
Division of Military Application

DATE: NOV 29 1963

FROM : H. L. Price  
Director of Regulation

SUBJECT: USE OF BIG ROCK POINT NUCLEAR PLANT AS PRACTICE BOMBING TARGET

It has come to our attention that the Strategic Air Command has been using the Big Rock Point Nuclear Power Plant of the Consumers Power Company at Charlevoix, Michigan, as a target for practice bombing runs. The nuclear reactor at Big Rock Point is licensed by the AEC and it is fully operational. We feel that the use of such an installation as a practice bombing target may create highly undesirable hazards.

The licensee at Big Rock Point has been informed that the SAC planes do not carry bombs during their practice runs. Some of the reported runs have been at altitudes as low as about one thousand feet and, for these runs, it has been possible for licensee personnel to confirm this information. It was reported, however, that the bomb bay doors were opened and the bomb release mechanisms were actuated to simulate bomb release.

In our opinion, it is not incredible that at some time an unfused bomb or dummy bomb could accidentally be in the bomb bay, or that a bomb could be accidentally released during a bombing run in which it was intended to carry but not release bombs. The possibility of a relatively small high explosive bomb or a heavy missile accidentally hitting and penetrating the reactor enclosure and causing or contributing to a nuclear incident is admittedly small. Nevertheless, we feel this remote possibility is unwarranted.

Your assistance in exploring the feasibility of having the Big Rock Point Plant removed from the SAC practice target list would be appreciated. Furthermore, because a reactor enclosure is an easily identifiable target (oftentimes a distinctive spherical or cylindrical shape), it appears likely to us that other licensed reactors might be used similarly either now or in the future. In view of this, it may be appropriate to establish a standing policy of avoiding the use of such installations as practice targets.

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Maj. Gen. A. W. Betts - 2 -

NOV 29 1963

If this is a matter which should be handled through the Military Liaison Committee, your help is solicited in bringing this request to their attention.

Harold L. Price  
Director of Regulation

Brigadier General Delmar L. Crowson, USAF  
Deputy Director of Military Application

DEC 24 1963

REG ROCK POINT NUCLEAR PLANT, CHARLEVOIX, MICHIGAN ✓

MA:AMW

Reference is made to your November 29 memorandum on the subject installation.

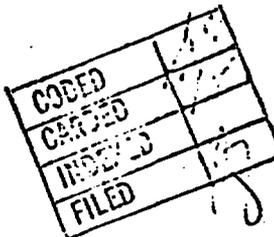
EMA has been informally advised that effective December 12, 1963, the Big Rock Point Nuclear Plant will not be used by SAC as a practice target.

The Air Force does not intend to use atomic reactors as simulated targets, and will obtain a list of such facilities from AEC to assure that such facilities are eliminated from consideration by SAC as simulated targets in the future.

The Military Liaison Committee and Department of the Air Force were very cooperative in handling the matter on an informal basis.

cc: - Addressee  
cc: Std EMA

at  
Ref: 3-10706 fm REG:Price



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OFFICE	MA:AMW	MA				
SURNAME	Wiltrott:sh	Crowson				
DATE	12/18/63	12/17/63				

UNITED STATES GOVERNMENT

DEC 26 1963

# Memorandum

TO : Brig. General Delmar L. Crowson, USAF  
Deputy Director of Military Application

FROM : Harold L. Price  
Director of Regulation

SUBJECT: BIG ROCK POINT NUCLEAR PLANT, CHARLEVOIX, MICHIGAN

This refers to your memorandum of December 24, 1963, stating that the Air Force will not continue to use the Big Rock Point Nuclear Plant or other atomic reactors as practice targets.

I very much appreciate your cooperation in this matter.

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SERIALIZED	FILED

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