9 JAN 1980

Mr. Falk Kantor
Division of Site Safety and Environmental Analysis
United States Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Kantor

Reference your conversation on 4 December 1979 with Lt Col Stoddard of this Directorate. The following responds to your request for an updated analysis of the risk associated with an accident between an aircraft on the IR 600/601 (Bayshore) low level training route and the Big Rock Point Nuclear Power Plant.

HQ USAF has performed the analysis based on current available data and a more conservative treatment of the component probabilities. The key facts which emerge from this analysis are:

(a) The probability of a crash in a 3 nautical mile square enclosing the power plant is less than one in a hundred million per year, and

(b) Even though the updated estimate is based on a more conservative methodology, the data themselves do not suggest any appreciable change in the risk to the power plant.

Notwithstanding the above, numerous actions have been taken to assure the 5 July 1979 inadvertent overflight of the power plant does not reoccur. An 13 July 1979 Strategic Air Command message requires these specific instructions and actions be taken by aircrews and radar bomb scoring site personnel:

(a) Scoring site personnel will provide radar warning to aircrews if the aircraft deviates 3 miles from centerline, and

(b) Aircrews will take positive actions to return to centerline.

This message further requires aircrew mission planning emphasis to insure that all aircrew personnel are aware of potential problem areas while the aircraft is operating near the nuclear facility. The above message with added information was supplied to Mr. Richard Silver, Division of Operating Reactors, Nuclear Regulatory Commission with our 30 July 79 letter.

We hope the above information will be of assistance to you, and will help satisfy any requirements that have developed in this regard.

Sincerely

Signed

DAVID L. NICHOLS, Col, USAF
Deputy Director for Operations
and Training
Directorate of Operations and
Training

1 Atch
Risk Analysis, 2 Jan 80

HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, DC 20330

REPLY TO ATTN OF: SAS

2 JAN 1980

SUBJECT: Risk Analysis of a Catastrophic Event at Bayshore Strategic Training Range (STR)

TO: AF/XOOT

1. As you requested, we have examined the risk of SAC aircraft crashing into the Big Rock Nuclear Power Plant while conducting low altitude training at the nearby (5.7 NM offset shown in Atch 1) Bayshore Strategic Training Range/Instrument Route (STR/IR 600/601).

a. Our calculations (summary in Atch 2) are based on an adaptation of the methodology of the original 1971 AF/OA study, but we utilized more recent data where appropriate and available.

b. This approach estimates the probability of a crash near Big Rock (i.e., in a 3 NM by 3 NM square enclosing the plant) to be less than one in a hundred million per year.

c. Even the introduction of still more conservatism into the estimate, to reflect the imprecise and judgmental nature of such a risk analysis, would not alter the basic result that the chance of a crash is extremely small.

2. The methodology is based on the observation that a crash into the power plant area can occur only by the combination of an overflight and a crash during a small segment of the total flight. This observation may be elaborated as follows:

a. An overflight (of the 3 NM by 3 NM square) can occur only if the bomber is badly off course and fails to correct.

b. In the event of such a gross navigational error, a corrective message is sent from the Bayshore site unless there is communication failure/ commercial power outage.

c. Given an uncorrected overflight, damage to the power plant would require crash in a three NM segment of a 430 NM route.

3. Data were available as follows:

a. Collection of route navigation information was limited to activity conducted from the period of 5 Oct to 30 Nov 79[1]. Gross navigational error

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[1]The only source of data are plot sheets from the site which are not retained for more than 6-9 weeks. The average position error and average deviation left and right of track of the power plant on the planned track was measured for 354 low altitude bomb runs from the available plot sheets.

information, in excess of four nautical miles either side of the planned track, was available covering the period 1 Nov 78 to 30 Oct 79. Total numerical low altitude activity was also available since 1971.

b. The site has two UHF radios and has never experienced a complete communications outage due to radio failure; however, loss of communications has occured during commercial power outages (20 hours in 3120 hours of operation).

c. Crash data are based on total similar low level training flights since 1971.[2]

4. Using the data referenced in paragraph three to estimate the probabilities of the events specified in paragraph 2, and multiplying the probabilities together, one arrives at a probability of $9.196\ 10^{-9}$ for the probability of a crash at the Big Rock Nuclear plant area, given 2986 training flights at Bayshore. As noted in paragraph 1 b, this is less than one chance in 100 million.

5. The current estimate quoted above is somewhat larger than the value of $1.47\ 10^{-10}$ given in the original AF/OA study. The difference is largely the result of a more conservative treatment of component probabilities in the current estimate. A very conservative treatment of gross navigational errors introduces a factor of ten, and the inclusion of power outages introduces a factor of three over the previous estimate of communication failure, which included only radio failures; a combination of other conservative changes introduce another factor of two.

6. One could be more conservative still. Instead of postulating statistical independence of the component events, which is the basis for multiplying probabilities, one could examine the consequences of a certain amount of dependence. Even if such considerations introduced a further factor of a hundred, however, one would still be dealing with an extremely low overall probability.

7. Despite the somewhat more conservative treatment of the present approach, the data themselves do not suggest any appreciable change in the risk to the Big Rock plant. That risk, even without more precise calculations, has been seen to be very low. It could, however, be made lower still by moving the training route further from the Big Rock plant, and it is our understanding that this possibility is now under examination.

8. It should be noted, however, that the impact of such a route change on the overall risk depends on the total context of operations near Big Rock. In the past year, for example, there were 76,993 flight operations at the six civilian airfields located within 25 NM of Big Rock (see Atch 1). Evaluation of their risk, and the risks of nuclear terrorism, etc., would be

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[2]Accident information was restricted to B-52 and FB-111 aircraft in flying low altitude bombing routes. There were three incidents, two FB-111s and a B-52C.

essential to any estimate of the overall impact of moving the Bayshore site.

9. Should any questions arise concerning this analysis please feel free to contact Maj Betourne, AF/SASB extension 53561.

2 Atch
1. IR-600 Chart
2. Probability Calculations

George F. Reinhart

GEORGE F. REINHART, Col, USAF
Director for Strategic Force Analyses
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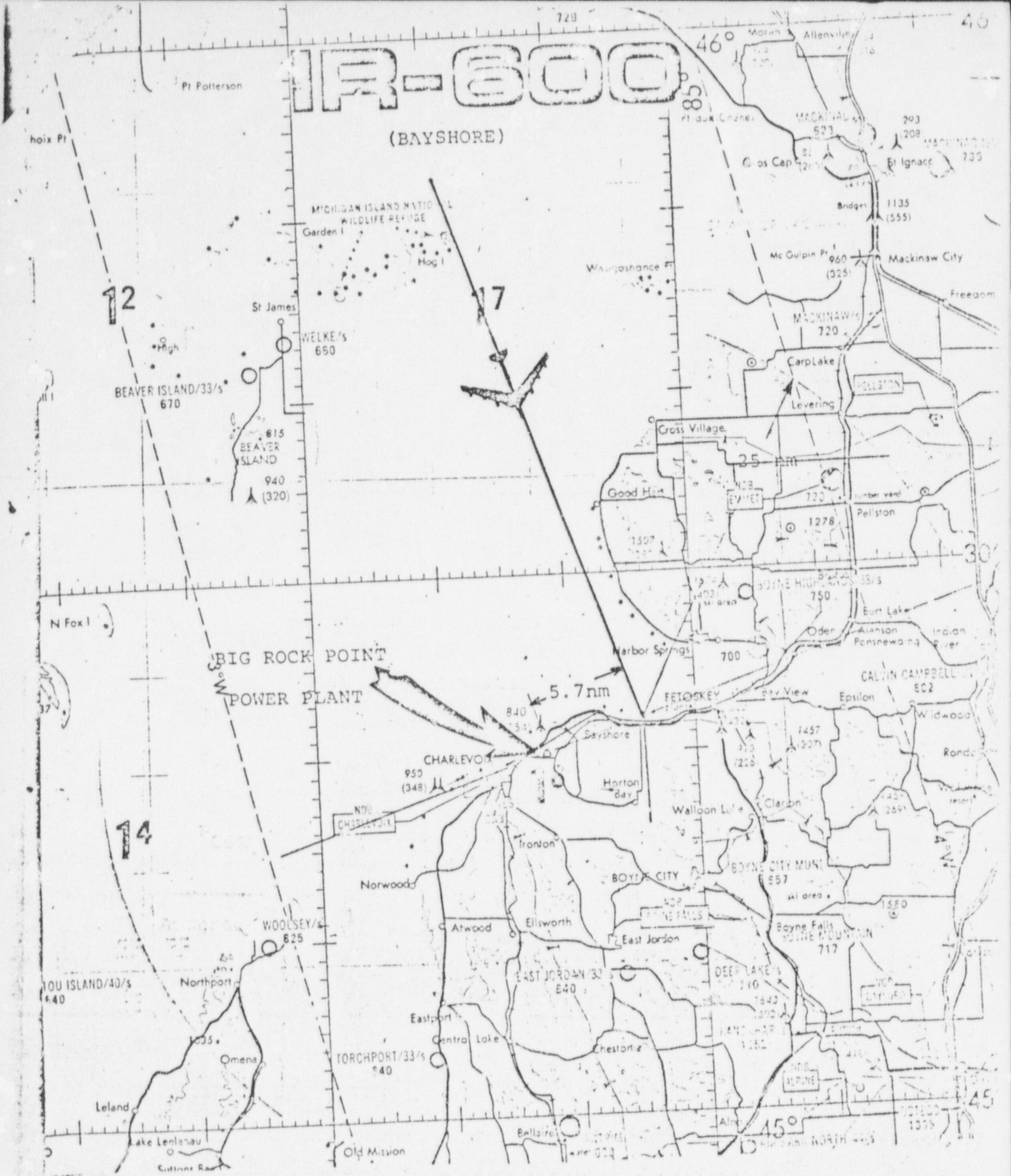

IR-600
(BAYSHORE)
BIG ROCK POINT
POWER PLANT
5.7nm
25 nm
17
12
14
Pt Potterson
St James
WELKE/s
660
BEAVER ISLAND/33/s
670
BEAVER
ISLAND
Garden I
Hog I
N Fox I
Harbor Springs
PETOSKEY
Bay View
Bayshore
CHARLEVOIX
Horton
Bay
Walloon Lake
Clarion
BOYNE CITY
BOYNE CITY MUNI
Norwood
Ironton
Atwood
Ellsworth
East Jordon
EAST JORDAN/33/s
840
Eastport
Central Lake
Chestonia
TORCHPORT/33/s
840
WOOLSEY/s
625
Northport
Omena
Leland
Lake Leelanau
Suttons Bay
Old Mission
Bellaire
Boyne Falls
DEER LAKE/s
Cross Village
Good Hart
Carp Lake
Levering
Pellston
Mackinaw City
St Ignace
Gros Cap
McGulpin Pt
Freedom
Burt Lake
Alanson
Oden
Indian River
CALVIN CAMPBELL
Epsilon
Wildwood
Moran
Allensville
46°
45°

PROBABILITY CALCULATIONS[1]

1970's Data

1. Radio failure--dominated by power outages of long duration. Outages are assumed to occur during five bomb runs. There were 2986 low altitude bomb runs at Bayshore this past year.

1 RF / 1834

$$P_{RF} = 5 / 2986 = 0.0016745$$

2. Gross error--defined as exceeding the 4 NM corridor either side of planned track. These are identified by the scoring site as 3 K ABORTS. There were 60 events this past year. All gross errors are assumed to the right (west) for conservatism.

$$P_{GE} = 60 / 2986 = 0.0200938$$

36E / 1654

3. Overflight - assumes radio failure and gross error must occur. The aircrew is not warned by the site to return to track.

$$P_O = P_{RF} \times P_{GE} = 3.36 \times 10^{-5}$$

4. Crash - considers all B-52 and FB-111 crashes during all low altitude activity. There were 229,390 low altitude runs during the time period of the crashes.

$$P_C = 3 / 229{,}390 = 0.00001308$$

5. Crash at specific point - assumes the crash will take place during one point on the 430 NM low altitude route.

$$P_{CP} = P_C \times 3 / 430 = 9.1256 \times 10^{-8}$$

6. Crash at Big Rock -

$$P_{CBR} = 3.0662 \times 10^{-12}$$

7. Crash at Big Rock during a year's activity.

$$P_{CBRY} = P_{CBR} \times 2986 = 9.1557 \times 10^{-9}$$

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[1] Accuracy to $10^{\pm 1}$