COMMONWEALTH EDISON COMPANY

ZION NUCLEAR POWER STATION

AIRCRAFT CRASH FIRE DETECTION SYSTEM ANALYSIS PROBABILISTIC RISK EVALUATION

FLUOR DANIEL
JANUARY 1989

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INTRODUCTION

The purpose of this study is to determine the need for an aircraft crash fire detection system at the Zion Nuclear Power Station. This is accomplished by a probabilistic risk evaluation to estimate the potential for an aircraft accident which could result in an exposure fire hazard at specific plant air intakes.

An analytical model showing the relationship of Zion Nuclear Power Station (ZNPS) to area airports and air traffic densities has been developed. The selection of the aircraft hazards to be evaluated has been in accordance with NUREG 0800 Standard Review Plan (SRP) Section 3.5.1.6 Aircraft Hazards (Rev. 2 - July 1981). In addition, current postcrash fire statistics have been used to further develop the analytical model. From this model, the probability of an aircraft crash which results in fire or smoke entering critical plant air intake vents has been estimated. The air intake vent areas analyzed are listed below:

Area A - Diesel Generator and Switchgear Room Ventilation System air intakes located at Elevation 592' on the west side of the Diesel Generator Rooms. (Unit 1 and Unit 2)

Area B - Auxiliary Building Ventilation System intake located at Elevation 642' on the north side of the Auxiliary Building.

Area C - Crib House Service Water Pump Area Ventilation System intakes located on the Crib House roof at Elevation 616'- 6".

CONCLUSION

The need for a postcrash fire detection system at the intake vents of the Zion Nuclear Power Station is unwarranted, due to the low probability of such an event occurring. Estimates of the probabilities per year of a postcrash aircraft accident involving a fire occurring with sufficient proximity to the ventilation intakes to present a hazard are listed below:

General Aviation Aircraft:

Area A - Diesel Generator Bldg. Vents..... 6.2×10^{-8} per year
Area B - Auxiliary Bldg. Vents..... 4.7×10^{-8} per year
Area C - Crib House Intake Vents..... 1.3×10^{-7} per year

Corporate Jet Aircraft:

Area A - Diesel Generator Bldg. Vents..... 7.4×10^{-9} per year
Area B - Auxiliary Bldg. Vents..... 5.7×10^{-9} per year
Area C - Crib House Intake Vents..... 1.5×10^{-8} per year

The probabilities listed above are based on the current level of aircraft activity at the Waukegan Regional Airport and the analytical model developed in this report. The lower probabilities of a corporate jet accident reflect the low number of operations of these aircraft (currently less than 6% of total operations).

Further investigation using other models, such as the SRP model, and the actual accident history at Waukegan Regional Airport confirms these low probabilities.

The calculated probabilities listed above have been based on conservative quantitative and qualitative assumptions. These assumptions are detailed in Section 6 and Section 7. Six qualitative arguments are presented that we believe conservatively further reduce the probability of an aircraft postcrash fire accident by 50%. The reduced probabilities with these qualitative arguments are listed below:

General Aviation Aircraft:

Area A - Diesel Generator Bldg. Vents..... 3.1×10^{-8} per year
Area B - Auxiliary Bldg. Vents..... 2.4×10^{-8} per year
Area C - Crib House Intake Vents..... 6.5×10^{-8} per year

Corporate Jet Aircraft:

Area A - Diesel Generator Bldg. Vents..... 3.7×10^{-9} per year
Area B - Auxiliary Bldg. Vents..... 2.9×10^{-9} per year
Area C - Crib House Intake Vents..... 7.5×10^{-9} per year

Current estimates indicate that total airport operations at Waukegan Regional Airport will grow at a 4.8% annual rate. Jet air traffic is expected to increase quickly and then level off due to the lengthened runway, control tower, and instrument landing system making the airport more available to these aircraft. Given these growth rates, the general aviation probabilities will not double until the year 2003. The corporate/business jet probabilities will be six times greater in the year 2008. At these years the probabilities will still be sufficiently low as to make maintenance of a postcrash fire detection system unwarranted.

1.0 Methodology and Description of the Analytical Model.

1.1 Identification of Aircraft Hazards.

Aircraft hazards near a nuclear power plant which are considered to have a sufficiently low probability of causing an aircraft accident are identified in NUREG 0800 Standard Review Plan Section 3.5.1.6 (Rev.2 - July 1981). These hazards are described below:

a) Airports between 5 and 10 miles which have less than 500 D^2 operations per year.

b) Airports further than 10 miles which have less than 1000 D^2 operations per year.

c) Federal airways, holding patterns or approach patterns beyond 2 miles of the plant site.

Where: D = Distance from plant site to the airport. (in statute miles)

Aircraft hazards which do not fall into the above categories must be evaluated in detail.

A review of the area around the Zion Nuclear Power Station (ZNPS) shows that the Waukegan Regional Airport (WRA) is the only airport within 5 miles. In addition, there are no other airports within a 5 to 10 mile radius of the ZNPS.

Airports further than 10 miles from the ZNPS but with relatively high air traffic include Pal-Waukee Airport at 23 miles, and O'Hare Airport at 30 miles. The number of operations for these and other airports in the area were obtained from the Federal Aviation Terminal Area Forecast for the base year 1986, and for forecasted activity in the year 2000.[1] None of these airports have operation levels which exceed the SRP Criteria and consequently do not require further consideration.

Analysis of area flight charts reveals that the two closest federal airways/aviation corridors in the area are "V-217" at approximately 6 statute miles from ZNPS and "V-7" at 10 statute miles from the plant site.[2] [3] These airways and corridors meet the acceptance criteria and therefore do not require further consideration.

Further analysis of aircraft hazards reveals an IFR (Instrument Flight Rules) holding pattern associated with the ILS (Instrument Landing System) of Runway 23. Since this holding pattern is within two miles of ZNPS, it does not meet the acceptance criteria and will be considered an aircraft hazard and treated separately in Section 6.2.

As outlined in the SRP, the final aircraft hazard probabilities will be the summation of the individual hazards.

1.2 Description of the Analytical Model.

In addition to defining the aircraft hazards which are to be considered, the SRP also provides a computational model for determining the probability of an aircraft crash within a given radius from an airport. The SRP equation for a single airport is as follows:

$$P_A = CNA$$

Where:

P_A = Probability per year of an aircraft crashing within a target area.

C = Probability of a fatal crash per square mile per aircraft operations.

N = Number of aircraft operations per year.

A = Effective target area (square miles).

For this evaluation, the crash probability "C" has been modified to include postcrash fires and serious accidents. The probabilities provided in the SRP only include fatal accidents (an accident where a fatality occurs within 15 days). Since postcrash fires also occur in many serious accidents (no deaths, but extended hospitalization), these accidents must also be included as a component of the crash probability "C."

In addition, the area "A" will be modified since reviews of the traffic patterns and flight tracks reveal that there is not a strong directional component in the air traffic patterns around WRA.

Studies of flight tracks of aircraft operations at WRA were performed by an independent consulting firm as part of the Part 150 Airport Noise Compatibility Planning Study - Part I.[4] Figures from this report are shown as Figures 1, 2 and 3 in Appendix 4. These figures along with conversations with tower officials confirm that the traffic patterns such as Right hand and Left hand approaches are being adhered to.[5] These flight tracks will be further investigated in Section 7.2.

These traffic patterns serve to regulate arrivals and departures to specific sides of a runway, rather than allowing arriving and departing traffic to approach a runway on a straight line course. This serves to help separate arriving and departing traffic and organize the flow of aircraft around the airport. Therefore after take-off and in stable flight the aircraft do turn rather quickly (within 1 mile) and then make directional changes appropriate to their intended destination. These directional changes when landing, or taking off are adhered to unless a strong directional

preference is needed for an intended destination. Intended destination or arrival points cannot be determined and must be considered to be random. Therefore, at the approximate distance of 3.5 miles ZNPS is from WRA, the traffic distribution is considered to be of a random distribution rather than directional.

An additional reason exists for these traffic patterns which tend to divert air traffic away from the ZNPS. Airspace around the Chicago area, including the airspace around Waukegan, is dominated by the O'Hare Terminal Control Area. The end of this control area is the Illinois-Wisconsin border. Aircraft taking off from WRA will preferentially stay within the Terminal Control Area (radio and radar contact) that they are in, rather than immediately transferring to another Terminal Control Area - in this particular case, the Wisconsin-Milwaukee Terminal Control Area. This is true unless their intended destination is toward the North. This fact, in addition to the Right and Left hand traffic patterns, causes the turning traffic patterns on take-off that exist at WRA. This can clearly be seen on Figure 2 in Appendix 4.

Arriving jet traffic at WRA can be considered an exception to the above model and therefore an additional method is outlined in Section 6.1.

For the above reasons, our formula will differ from the SRP formula in the following areas. First, the crash probability "C" will be re-derived using current air crash statistics involving both serious and fatal accidents. New data is warranted since statistics show that the general aviation and corporate/executive aviation accident rates per 100,000 hours flown have shown a definite decrease from the years 1975 to the present.[6] [7]

The second change will be that the target area definition will be modified to reflect the derivation of the new postcrash fire statistics. The area used for the derivation of "C" will only include the area within a 3 to 4 mile radius of an airport. By using this area, accidents occurring during taxing or on the airport runway will be excluded. The target area of the plant site will then represent a portion of the 3 to 4 mile radius area. The modified equation used in this study, will be as follows:

$P_A = CNA$

Where:

P_A = Probability of an aircraft crashing at the ZNPS which results in a postcrash fire with sufficient proximity to the previously listed ventilation intake vents to provide an exposure fire hazard at those intakes.

C = Probability of a postcrash fire occurring during a fatal or serious accident within a 3 to 4 mile radius of an airport (per operation).

N = Number of operations per year at Waukegan Regional Airport.

A = Effective target area as a portion of the 3 to 4 mile radius (Target Area divided by the 3 to 4 mile radius area in square miles).

The above equation and statistics utilize historical crash data for general aviation personal and business flying. This category accounts for almost all the air traffic at WRA. An Illinois Department of Transportation study of WRA traffic dated May 1985 states that over 98% of the activity was in this category.[8] Reviews of daily tower records confirm this fact.[9]

2.0 Description, Location and Orientation of Waukegan Regional Airport Relative to the Zion Nuclear Station.

2.1 Description of Waukegan Regional Airport.

Waukegan Regional Airport is located in Lake County, IL, approximately 2 1/2 miles from the center of the City of Zion, IL. WRA is classified by the Federal Aviation Administration as a public towered airport. The control tower commenced operation on October 1, 1988. Current and historical figures indicate that over 98% of the activity of WRA is considered to be general aviation of the personal or business variety.

WRA has two runways numbered as 5/23 and 14/32. Runway 5/23 is rated at 6000 feet, and runway 14/32 is rated at 3750 feet. Each runway can be approached from either direction. These runways, along with their orientations to WRA and to the ZNPS, can be seen in Figure 1.

2.2 Location of the ZNPS relative to WRA.

ZNPS is located on the western shore of Lake Michigan with the City limits of Zion, IL. ZNPS is located at a distance of 3.14 miles from WRA. This figure represents the distance from the end of runway 5/23 to the centerline of the two containment buildings. Additionally, ZNPS is located .76 miles from the extended centerline of runway 5/23. These figures include the 1400 foot extension of runway 23 which was completed in May, 1985. A graphical presentation of the above information is shown in Figure 1.

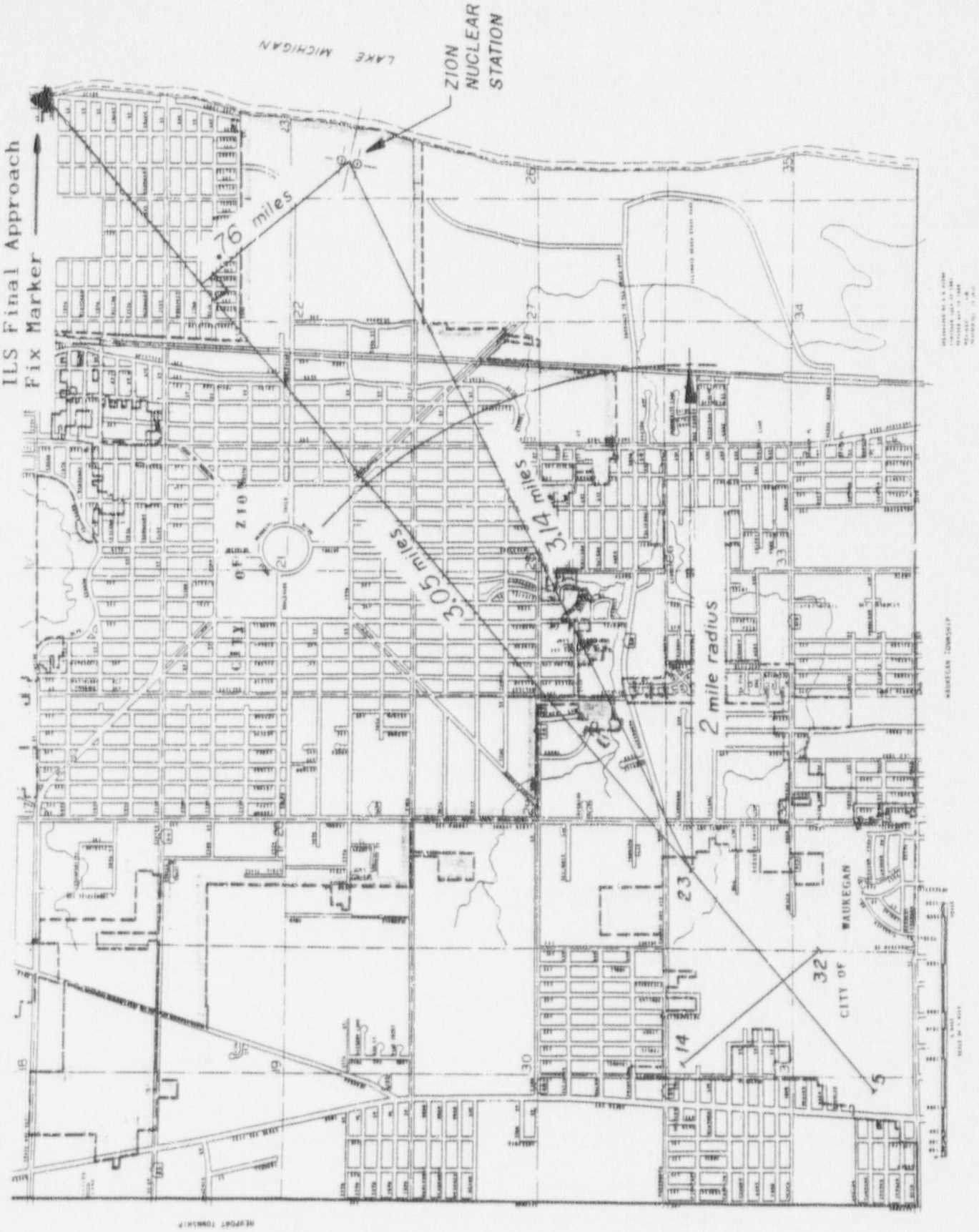


FIGURE 1

Location and Orientation of Waukegan Regional Airport
to the Zion Nuclear Power Station

3.0 Operation Numbers of Waukegan Regional Airport

The number of operations at an airport refers to the number of take-offs, landings, and touch and go's (a landing and take-off without stopping). Touch and go operations occur frequently at airports with a high level of training activity such as WRA. Tower airports are required to record each operation, but at a non-tower airport operation numbers are usually only an estimate. As noted earlier, previous to October 1, 1988 WRA was a non-tower airport.

Both tower and non-tower airports must register a 5010 form with the FAA which includes the number of operations and other data concerning airport operations. The 5010 form for WRA dated 08-14-84 stated that there were 214,300 operations during the past year. Comparisons for the same year with two of the areas largest general aviation airports show Pal-Waukee with 150,000 operations per year, and Bowman Field with 238,000 operations per year. Both airports are larger and have greater number of runways. Therefore, these early 5010 figures for WRA seem disproportionally high.

Independent traffic counts undertaken in the summer of 1985 at WRA also corroborated this view. An in-field traffic count completed in May 1985 resulted in an estimate of 97,511 operations per year. A consulting firm working on a Phase I Layout Plan Report completed a more thorough study. The numbers from this report show 121,618 operations per year. Both reports are also in agreement that over 95% of the current general aviation traffic consists of single or twin engine propeller aircraft, with approximately 5% business jet aircraft.

The consulting firm working on the Part 150 Airport Noise Compatibility Study also reviewed operation numbers at WRA.[10] This report also determined that the traffic count number of 121,618 was a valid estimate and used this number in their report. Further investigation by this firm relating to their aircraft noise study broke this operation number into type of aircraft. These figures are shown in Table 1 below:

Table 1

Annual Operations at Waukegan Regional Airport by Aircraft Type

	1986		1991 Forecast	
Type	Annual Operations	Percent Night	Annual Operations	Percent Night
Gulfstream G2/G3	2,526	0.05	7,800	4.4
Small Jet	4,395	0.05	11,500	5.0
Gulfstream G1	540	0.00	730	0.0
Small Turbo-prop	4,161	0.05	11,500	5.0
Small 2-Engine Prop	3,781	0.06	5,000	5.1
Small 1-Engine Prop	106,215	0.02	138,350	2.4
TOTAL	121,618		174,880	

The above numbers are based on in-field traffic counts representing only small time periods that are used as averages. With the control tower now in operation even more accurate operation numbers can be obtained. The control tower is in operation from 6:00AM to 8:00PM. This time period represents over 99% of the airport activity.

Tower airports must keep daily records of total operations. For this study the daily operations were obtained from Waukegan Port District offices for the months of October and November of 1988. These are the only months available,

since tower operation commenced on October 1, 1988). Copies of these reports are shown in Appendix 1. Total activity for the month of October is recorded as 9,264 operations, and November 1988 activity is recorded as 7,130 operations.

In order to create an accurate yearly operation number from these two months of data, the monthly operation records of the Pal-Waukee airport (a similar general aviation airport) were obtained.[11] The monthly seasonality of the two airports would be expected to be similar since both airports would both be experiencing the same weather patterns. Using the same monthly percentage values of the two airports, the operations per year number of WRA was calculated to be 105,013. To this figure, 1% additional operations per year were added to account for activity outside of the tower control hours. Therefore, the total number of operations per year for the base year 1988 has been calculated to be 106,063.

This close agreement of the earlier traffic count and the yearly value as calculated from actual monthly operations gives a high degree of confidence in our yearly operations number. Since this operation per year number has been calculated from newer data (1988 versus 1985) and from actual daily data (rather than one to two week traffic counts), it will be used as the base year operations per year number for the purpose of this study.

The breakdown by aircraft type does not appear on the daily Airport Traffic Record. For this reason the aircraft type breakdown used for the Part 150 Airport Noise Compatibility Study described above will be adopted for use here. For this study, the breakdown of aircraft type will be divided into two categories. This is necessary because of the

difference in operations per year, accident history, and expected growth rate of the two categories of aircraft.

The first and largest category will represent general aviation single and double engine propeller aircraft, including small turbo-prop aircraft. These aircraft are generally used for personal, training, and recreational flying. The second category will be small jet aircraft typically used for corporate business flying. Typical aircraft of this type would be the Gulfstream G2/G3 and Lear Jet varieties.

In summary, Table 2 below shows the aircraft operations at WRA per year by category that will be used in this study.

Table 2

Annual Operations at Waukegan Regional Airport by Aircraft Type
Base Year 1988

TYPE:	1988 Annual Operations	Percent
CATEGORY I General Aviation - Single engine - Twin engine - Small Turbo-prop	100,027	94.3%
CATEGORY II Business jet aircraft - Gulfstream G2/G3 - Small jet	6,036	5.7%
TOTALS	106,063	100%

3.1 Local Versus Itinerant Traffic

Local airport operations are defined by the FAA as operations performed by aircraft which:

(a) Operate in the local traffic pattern or within sight of the airport.

(b) Are known to be departing for, or arriving from, flight in local practice areas within a 20-mile radius of the airport.

(c) Execute simulated instrument approaches or low passes at the airport.

Itinerant operations are all aircraft operations other than local operations.[12]

The percentage of local and itinerant aircraft operations at WRA is shown on the daily Aircraft Traffic Record. The percentage is approximately 50% local and 50% itinerant (see Appendix 1). Many of these local operations are training flights that operate in very close proximity of the airport. Touch and go landing and training operations are included in these operation numbers, and each touch and go is recorded twice, once for a landing and once for a take-off. This recording method increases the local operation number and, therefore, increases the total operation number.

These training touch and go operations increase the operational numbers of the airport, but these training flights tend to stay in very tight circles around the airport (within 1 mile) practicing numerous take-offs and landings and rarely venturing on long flight excursions. Typical flight tracks of these touch and go operations can be seen in Figure 1 of Appendix 4. This issue will be further developed in Sec. 7.1.

4.0 Development of General Aviation Postcrash Fire Statistics

4.1 Introduction

This section contains an explanation and derivation of the aircraft crash statistics used in the analytical model.

The following information must be known to determine the number of general aviation accidents per operation that result in a postcrash fire within a 3 to 4 mile radius of an airport:

1) The total number of general aviation aircraft operations occurring at both tower and nontower airports within the database considered.

2) The total number of serious and fatal accidents involving general aviation aircraft occurring within a 3 to 4 mile radius of an airport within the data base considered.

3) The percentage of accidents, as listed above, which result in a postcrash fire.

The database to be considered for the analytical model will be general aviation flying within the United States, since United States general aviation flying is most representative of the flying done at WRA. In addition, the data available is accurate and complete.

4.2 Number of General Aviation Aircraft Operations in The United States (Years 1977-1981)

To determine the number of general aviation aircraft operations in the United States, the number of operations at both tower and non-tower operations must be added. The number of general aviation operations at tower airports can be obtained from the FAA Terminal Area Forecasts.[13] Tower airports are required by the FAA to record each operation.

Non-tower airports include small airports and private runways. No records of operations are kept for this group. The best estimate of total general aviation operations can be obtained from the FAA Terminal Area Forecasts. The figures given represent estimates of general aviation total operations at 4000 public use airports. FAA officials stated that these numbers represent 85% of all general aviation aircraft operations.[14] The figures given in Table 3 represent the figures published in the FAA forecast plus 15%. This increase includes the small and private airports that are not covered in the 4000 airport data base. There-fore, for the five year period 1977 through 1981, it is estimated that there were 679.5 million general aviation operations.

Table 3

Total Number of Tower and Non-Tower General Aviation Aircraft Operations (Years 1977 - 1981)

	1977	1978	1979	1980	1981	Total years 1977 thru 1981
Aircraft Operations (Millions)	125.2	133.3	138.4	142.6	140.1	679.5

4.3 Number of Serious and Fatal Accidents Involving General Aviation Aircraft, Occurring With a 3 to 4 Mile Radius of an Airport.

Data regarding fatal and serious general aviation accidents were obtained from The National Transportation Safety Board database and are presented in Appendix 3.[15] Table 4 shows a summary of the pertinent data. Only the years 1977 through 1981 can be used since after this date the NTSB does not separate accidents into distances from the airports. For the 5 year period, 1977 through 1981, there were 101 fatal and serious accidents occurring within 3 to 4 miles of an airport.

Table 4

Total Number of Fatal and Serious
General Aviation Accidents (Years 1977 - 1981)
(within 3 to 4 miles of an airport)

	1977	1978	1979	1980	1981	TOTAL
Fatal Accidents	18	14	11	14	13	70
Serious Accidents	5	6	4	7	9	31
Total	23	20	15	21	22	101

4.4 Percentage of Fatal and Serious General Aviation Accidents Which Resulted in a Postcrash Fire.

Data pertaining to postcrash fires in general aviation aircraft accidents were also available from the National Transportation Safety Board.[15] Table 5 shows a summary of the pertinent data.

Table 5

Percentage of Fatal and Serious General Aviation Accidents
Which Resulted in Postcrash Fires
(Years 1977 - 1985)

	Fatal And Serious Accidents	Number of Postcrash Fires	Percentage of Postcrash Fires
1977	1,061	237	22.3%
1978	1,146	222	19.4%
1979	1,005	213	21.2%
1980	1,016	191	18.8%
1981	1,003	241	24.0%
1982	946	216	22.8%
1983	883	166	18.8%
1984	904	203	22.5%
1985	816	181	22.2%
		Average 1977 through 1985	21.3%

For the nine year period, 1977 through 1985, an average of 21.3% of fatal and serious accidents resulted in a postcrash fire.

4.5 Conclusion and Results.

From the figures developed above, the following statistics for general aviation fatal and serious accidents which resulted in postcrash fires have been developed.

By dividing the number of tower and non-tower general aviation operations in the U.S. (Section 4.2) into the number of fatal and serious accidents with a 3 to 4 mile radius (Section 4.3), the following figure is developed:

$$\frac{101}{6.795 \times 10^{8}} = 1.49 \times 10^{-7} \text{ fatal and serious accidents per operation}$$

Multiplying the figure above, by the percentage of postcrash fires (Section 4.4), gives the final result, as listed below:

$$1.49 \times 10^{-7} \times 21.3\% = 3.17 \times 10^{-8}$$

This figure represents an estimate of the number of postcrash fires per operation that would be expected to occur in fatal and serious accidents within a 3 to 4 mile radius of an airport.

5.0 Specific Plant Target Areas.

5.1 Introduction and Description of Methodology.

In choosing the plant target areas, the type of aircraft which is postulated to be involved in the crash must be considered. Statistics presented previously have shown that WRA is used exclusively by general aviation aircraft. In addition, WRA operation statistics indicate that close to 90% of the airport operations are by single engine propeller type aircraft. This has been true of past operation figures, and it is expected to hold true for the future. Since the primary concern of this study is fire, fuel loading of the aircraft postulated to crash must also be taken into account. This evaluation will conservatively assume that the plane will be fully loaded with fuel at the time of impact. An average fully loaded single engine propeller plane has a fuel capacity of approximately 50 gallons of aviation quality gasoline. This capacity will be doubled to 100 gallons of fuel for the analysis of corporate/business jet aircraft.

The damage area at the impact site can be divided into two components. The first and most serious threat to the vents is the direct contact of fuel or flames. The second threat is from heat or smoke entering the vents. The distance of fuel or flame spread can be estimated by determining the area that unignited fuel could spread over a surface. Data from the analysis of fuel spills indicate that in a fuel spill, each gallon of liquid will cover approximately 20 square ft. of level surface.[16] Comparisons with data from the Fire Protection Handbook, using conservative calculations, confirm this figure.[17] Therefore, a 50 gallon spill would

cover 1000 square feet, or a circle of approximately 18 feet in radius. As a factor of safety, and to include radiant heat effects, a circle of 20 foot radius has been chosen as the affected area. This figure represents the worst case situation where a plane loses all of its fuel at the impact site, prior to ignition.

Smoke and heat threats to the vents are also estimated conservatively. A smoke and heat zone around the 20 foot radius of flame and fume damage is also estimated at 20 feet. The total area of a 40 foot radius around the impact site is an estimate of both the flame and heat damaged areas. This distance is used to indicate the maximum distance at which a crash may occur and not cause fire, fumes, or smoke to enter the air intake vents. In some cases, the particular geometry of a vent may cause this distance to be modified.

Sections 5.2 through 5.4 describe the particular target areas chosen for each intake vent area. Figure 2 shows these vent locations and target areas on a property development plan of the ZNPS.

5.2 Target Area A - Diesel Generator and Switchgear Room Ventilation System Air Intakes Located at Elevation 592' on the East Side of the Diesel Generator Rooms (Unit 1 & 2).

Figure 3 shows a sketch of the Unit #1 Diesel Generator Building. Shown in this sketch is the 20 foot radius flame and fuel area along with the 20 foot smoke and heat buffer zone. This area around the intake vents comprises 11,400 square feet, or 4.10×10^{-4} square miles. The target area for the Diesel Generator Building Ventilation Intakes for Unit #2 is approximately equal to the area target area for Unit #1.

5.3 Target Area B - Auxiliary Building Ventilation System Intake, Located at Elevation 642' on the North Side of the Auxiliary Building.

Figure 4 shows a sketch of the north wall of the Auxiliary Building; the 20 foot flame and fuel area is shown along with the smoke and heat buffer zone. This area comprises 8,640 square feet, or 3.10×10^{-4} square miles.

5.4 Target Area C - Crib House Service Water Pump Area Ventilation System Intakes Located on the Crib House Roof at Elevation 616'-6".

The target area for the Crib House intake vents is different from the other areas. The target area for the Crib House vent will be the entire roof along with the fuel and spill radius and smoke and heat buffer zone. This area is enlarged for the following reasons: (1) The three levels of the Crib House Roof make fuel distribution easier and (2) The Crib House air intake vents are not obstructed by other plant structures making the number of approach angles to the vents much greater. The target area of 22,533 square feet, or 8.08×10^{-4} square miles, is shown in Figure 5.

The target areas will be doubled when used in the probability calculations for corporate/business jet operations to reflect the increased fuel spill and possible damage area.

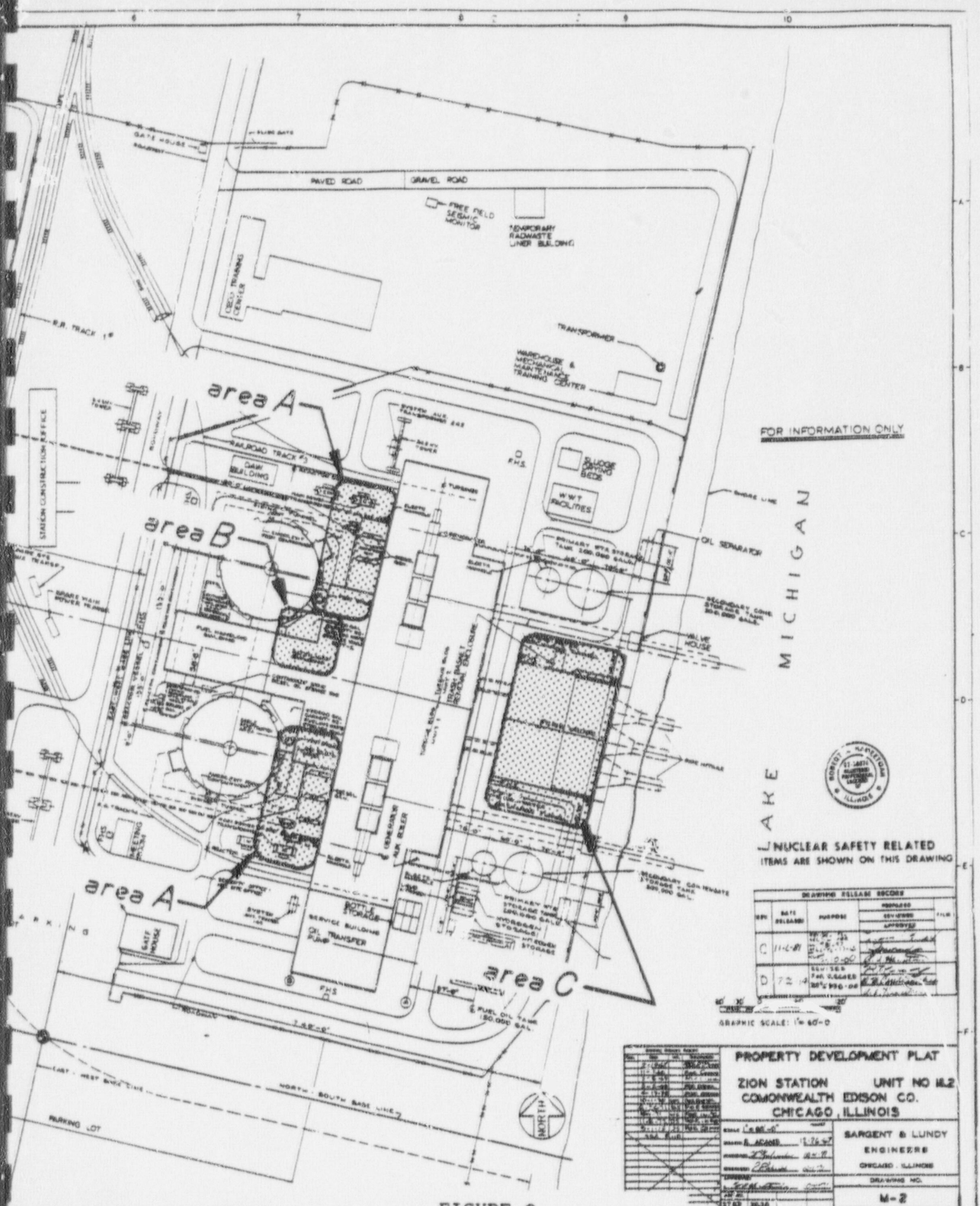
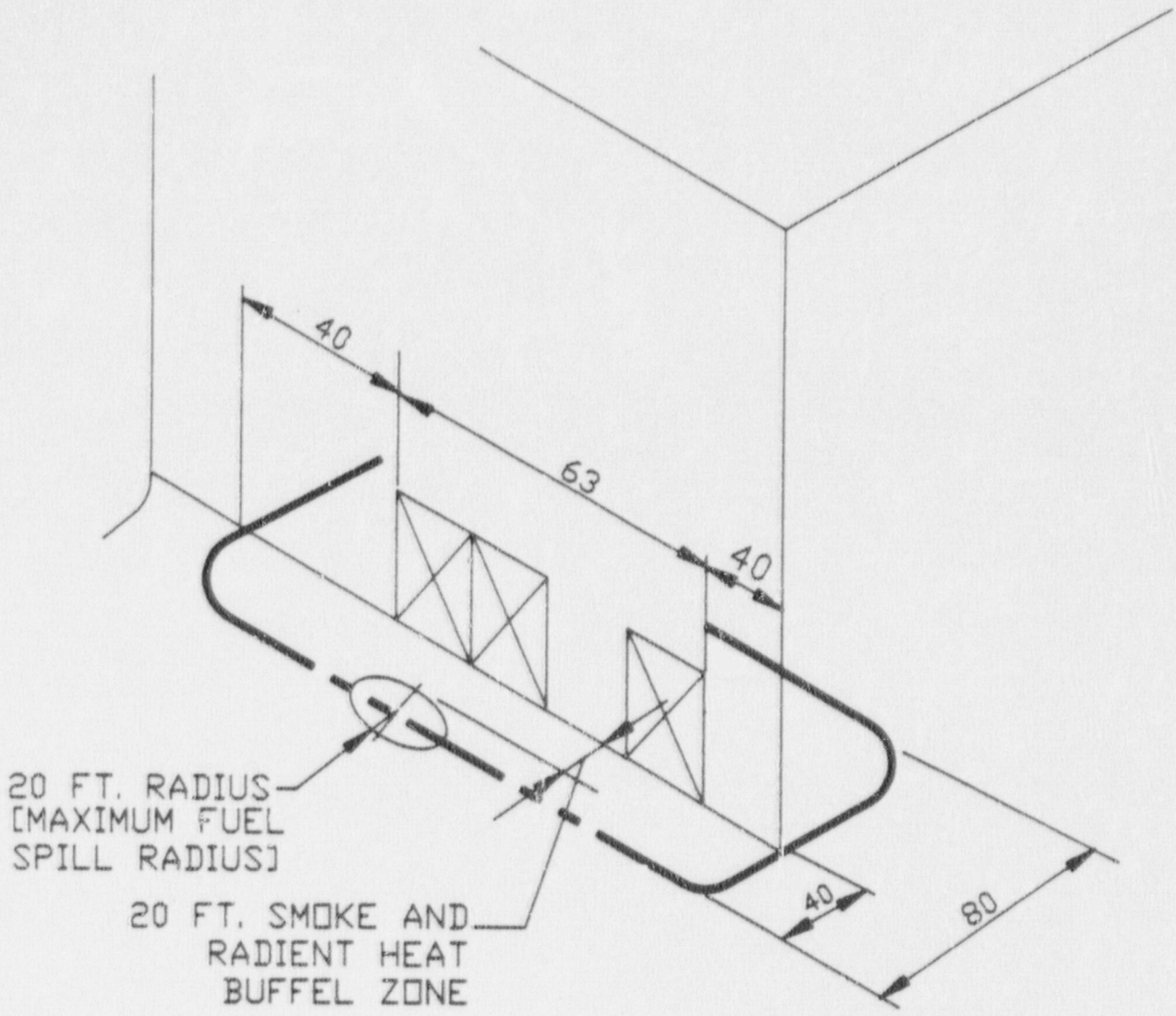


FIGURE 2

Property Development Plan Showing
Impact Areas



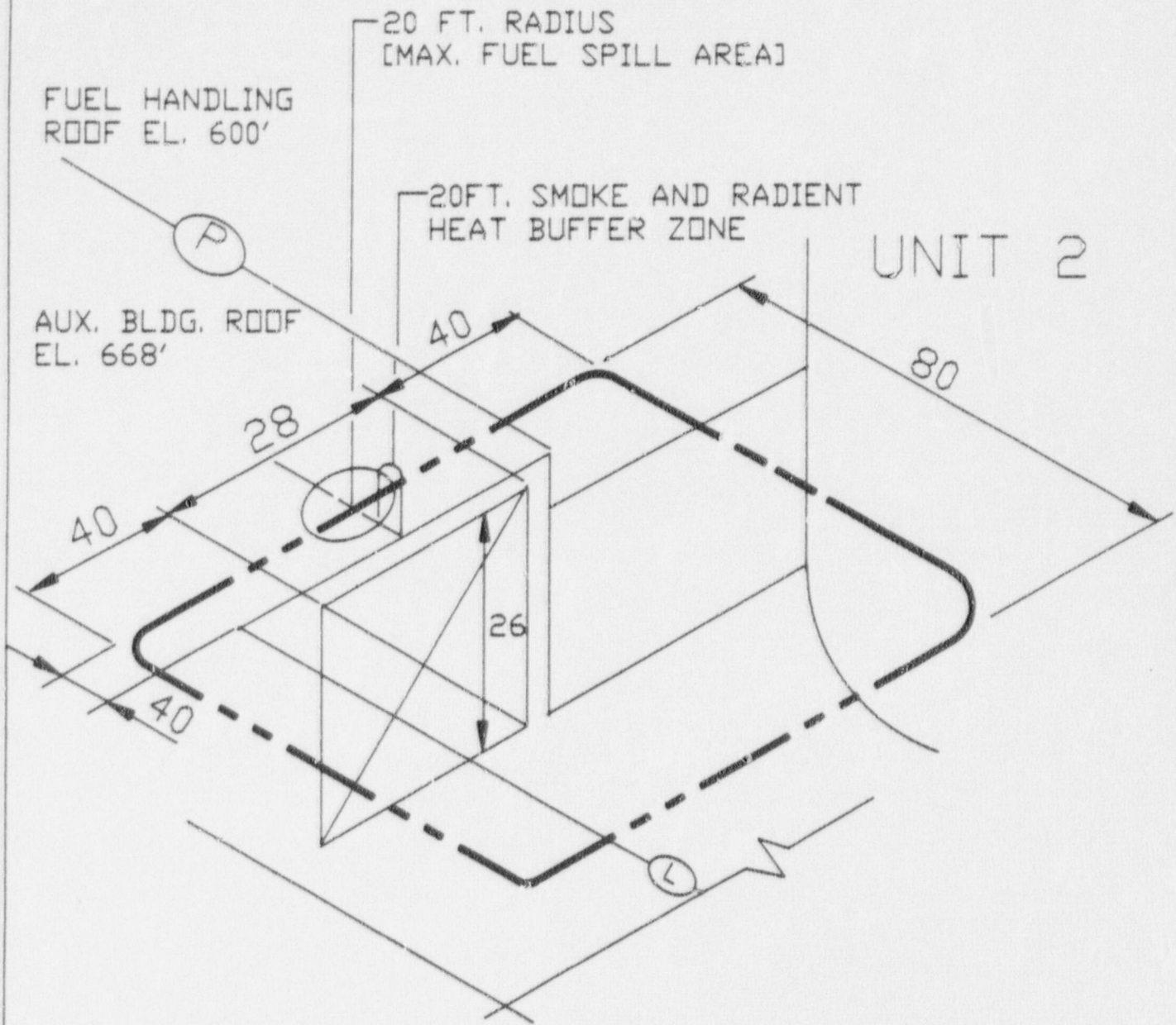
AREA=11,440FT^2, 4.10×10^{-4} MILES^2

FIGURE 3

AREA A-DIESEL GENERATOR AND SWITCHGEAR ROOM VENTILATION INTAKES

REF. DWG. M-378 (UNIT 1)
M-380-D (UNIT2)

NOT TO SCALE



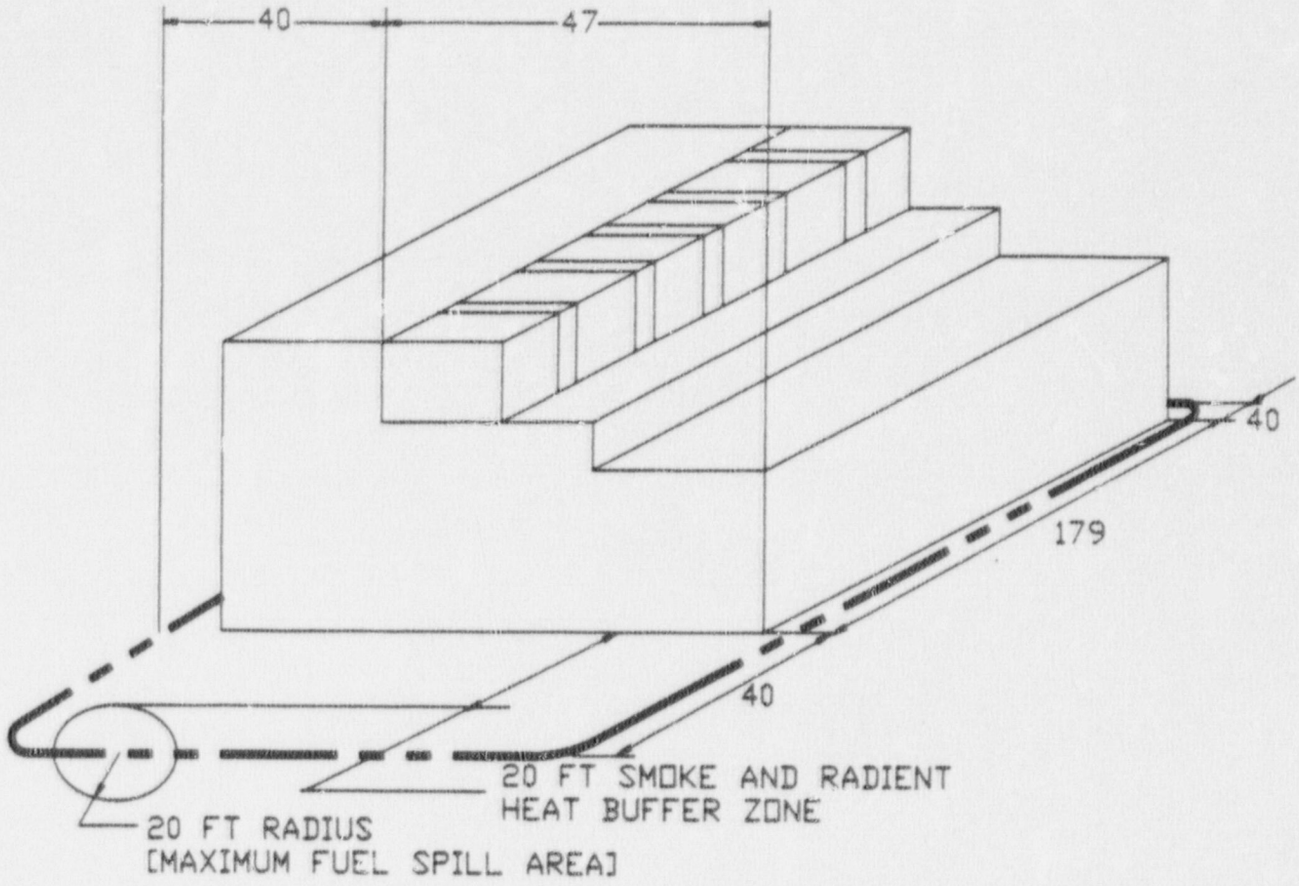
AREA=8,640 FT.^{2}, 3.10×10^{-4} MILES^2

FIGURE 4

AREA B-AUXILIARY BUILDING VENTILATION SYSTEM AIR INTAKES

REF. DWG. M-311

NOT TO SCALE



AREA=22,533FT.^{2}, 8.08X10^{-4} MILES^2

FIGURE 5

AREA C-CRIB HOUSE SERVICE WATER PUMP AREA VENTILATION SYSTEM AIR INTAKES

REF. DWGS. B-698 AND M-320

NOT TO SCALE

6.0 Quantitative Evaluation

With the earlier listed information complete, the following data can be summarized as follows:

1. Number of yearly operations per year at WRA (From Section 3)

   Category I - General Aviation Aircraft

   N = 100,027 (base year 1988)

   Category II - Business Jet Aircraft

   N = 6,036 (base year 1988)

2. Postcrash fire statistics for general aviation (From Section 4)

   $C = 3.17 \times 10^{-8}$ per operation

3. Target Areas (Section 5)

   Area A Diesel Generator
   Vents Unit 1 and Unit 2 ...4.10×10^{-4} square mile

   Area B Auxiliary Building
   Vents .....3.10×10^{-4} square mile

   Area C Crib House Roof
   Vents .....8.08×10^{-4} square mile

The above data can now be used as input to the previously derived equation (Section 1.0) of $P_A = CNA$. The areas "A" in the equation are the target areas divided by the total area (3 to 4 mile radius) used in the derivation of the postcrash fire statistics. Using the equation for each of the target areas yields the following results:

General Aviation Aircraft:

Area A - Diesel Generator Bldg. Vents.... 5.9×10^{-8} per year
Area B - Auxiliary Bldg. Vents..... 4.5×10^{-8} per year
Area C - Crib House Intake Vents..... 1.2×10^{-7} per year

Corporate Jet Aircraft:

Area A - Diesel Generator Bldg. Vents.....7.1×10^{-9} per year
Area B - Auxiliary Bldg. Vents.....5.4×10^{-9} per year
Area C - Crib House Intake Vents.....1.4×10^{-8} per year

These probabilities represent the risk associated with aircraft operations at WRA. These values will be added to the probabilities developed for the risk associated with the Instrument Landing System holding pattern to obtain the total probabilities.

6.1 Probability Risk Assessment of Runway 23 Instrument Landing System Holding Pattern

A review of current aircraft charts and conversations with WRA tower officials indicate a holding pattern associated with the Instrument Landing System (ILS) of runway 23. The edge of this holding pattern is within 1/2 mile of ZNPS, therefore this aircraft risk must be quantitatively identified.

Actual records of flight traffic in this holding pattern are not kept by tower officials, but estimates of its use with multiple aircraft in this holding pattern are very low. The SRP method recommends treating the holding pattern as an aircraft passage using the formula as given in Section III.2.

Since the actual number of operations per year in this holding pattern are not available, an ultra conservative approach is to treat all of the incoming aircraft to runway 23 as using this holding pattern. Using this conservative approach yields only a slight increase in the overall aircraft crash risk to the ZNPS.

Using the SRP formula of $P_{FA} = C \times N \times A/w$ for airways, the following crash probabilities per year can be developed:

The number of operations per year "N" in the holding pattern (airway) will be obtained from the total operations per year value as developed in Section 3.0 and the estimate that 70% of the landings will be from the northeast.[20] In addition, the number of arriving and departing operations will be assumed to be the same. Therefore, the number of operations per year for the above equation will be:

	Operations per Year	
	General Aviation	Corporate/ Business
Total Operations (Section 3.0)	100,027	6,036
Number of landings (50%)	50,013	3,018
N = Landings from the northeast (70% on runway 23 assumed to used the ILS holding pattern	35,009	2,113

The area "A" in the equation will be the previously defined target areas (Section 5). As outlined earlier, the area for the corporate/business jet aircraft category will be doubled.

The width of the airway "w," as defined in the SRP, will be 1 3/4 miles wide, as estimated from aircraft charts, plus 2 times the pattern. Therefore, the total value of "w" will be 2.15 miles.

An approximate value of "C" for the equation can be obtained by using the value of 4×10^{-10} crash rate per mile for commercial aircraft given in the SRP, and increasing it for the higher crash rates found in general aviation flying. This increase can be obtained by averaging the increases listed for the probability of a fatal crash per square mile per aircraft movement from Section III.3 of the SRP. The average increase in the aircraft fatal crash per square mile between U.S. Air Carrier and General Aviation aircraft is approximately 5 times as great. Therefore, the value for "C" in the above equation will be 2×10^{-9}.

Finally, this value "C" will be modified by multiplying it by the post-crash fire statistic of 21.3% developed earlier (Section 4.4).

Application of the above equation with these values yields the following post-crash fire risk associated with the holding pattern of the Instrument Landing System of Runway 23:

General Aviation Aircraft:

Area A - Diesel Generator Bldg. Vents.... 2.9×10^{-9} per year
Area B - Auxiliary Bldg. Vents..... 2.2×10^{-9} per year
Area C - Crib House Intake Vents..... 5.6×10^{-9} per year

Corporate Jet Aircraft:

Area A - Diesel Generator Bldg. Vents.....3.4×10^{-10} per year
Area B - Auxiliary Bldg. Vents.....2.6×10^{-10} per year
Area C - Crib House Intake Vents.....6.8×10^{-10} per year

These numbers will be added to the earlier calculated probabilities (Section 6.0) to obtain the total post-crash fire risk probability values.

6.2 Comparison With Other Analytical Models - Corporate/Business Jet Travel.

The operation numbers and calculated probabilities presented earlier have been divided into two categories reflecting the different types of flying and the different expected rates of growth at WRA. In addition, conversations with tower officials and an analysis of the flight tracks reveal that these aircraft should be treated separately.

Business/corporate jet traffic which is categorized by the Gulfstream G1/G2 and Lear jet varieties, is limited to the use of runway 5/23, the longest runway.[5][18] This limits takeoffs and landings to the southwest and northeast. Since these larger aircraft have a larger turning radius, they typically will approach a runway at a direct heading from a further distance than will small general aviation aircraft. In addition, on landing, they will use an Instrument Landing System (ILS), that will insure that they will be on a straight line approach to the runway at a distance of about 5 miles, at the Final Approach Fix Marker.[5] The location of this marker can be seen in Figure 1.

For these reasons an additional calculation of the probability values will be performed using the model as

briefly outlined in the SRP. A review of the source of the probability values given in the SRP reveal that they were calculated from crash statistics "within a 60-degree reference flight path symmetric about the extended centerline of the runway."[19]

Since landing jet traffic at WRA would fall into this 60 degree angle from runway 5/23 on a straight line approach, the crash fire probabilities of this category of flying will be additionally calculated, using the SRP crash numbers modified only by the inclusion of the postcrash fire percentage derived in Section 4.4. The value of the probability number C will be taken from the U.S. Air Carrier category at the 3 to 4 mile distance from the end of the runway. This choice is warranted since business and corporate flying has a lower fatal accident rate as compared to general aviation personal or training flying, typically by a factor of 5.[7]

Using the total yearly number of corporate jet aircraft operations developed earlier, an estimate of the number of jet operations using runway 23 that would be near the ZNPS within the 60 degree area symmetric about the runway centerline can be calculated.

Historical wind data, conversations with tower officials, and reviews of the Part 150 Airport Noise Compatibility Planning Study Part I indicate that approximately 70% of all take-off operations are to the southwest.[5][20] This is due to the fact that aircraft on takeoff will preferentially choose take-offs into the wind. Similarly, landing operations favor a tail wind, and 70% percent of these operations can be assumed to take place from the northeast. Additionally, the number of take-offs and landings at an airport can be assumed to be equal.

Using these arguments, the number of corporate/business jet aircraft that would be arriving from or departing to the northeast (runway 5/23) near the vicinity of the ZNPS can be developed:

Number of corporate/business jet operations per year (Section 3.0)

N = 6,036 operations per year

Number of take-offs = N/2		30% to the northeast	
3,018		905	
Number of arrivals = N/2		70% from the northeast	
3,018		2,113	

	Total	3,018	business jet operations per year using runway 5/23 to/from the northeast.

Using the above operations numbers for runway 5/23 to the northeast, (3,018) the Air Carrier Probability of a Fatal Crash per square mile per Aircraft Movement from the SRP model ($.68 \times 10^{-8}$ at a 3 to 4 mile distance), and twice the target areas developed earlier, the following probabilities can be developed:

Area A - Diesel Generator Bldg. Vents..... 1.7×10^{-8} per year
Area B - Auxiliary Bldg. Vents..... 1.3×10^{-8} per year
Area C - Crib House Intake Vents..... 3.3×10^{-8} per year

The probabilities listed above are well below the threshold value of 1.0×10^{-7} per year that is listed in the SRP documents. A direct comparison with the formula developed in this study is not applicable unless the differences between the two methods is addressed.

The model developed in this report includes both fatal and serious accidents, since both categories of accidents can cause postcrash fires. In addition, the postcrash fire percentage is included. An approximate comparison can be made if the post crash fire static is applied to the SRP formula. Applying the 21.3% postcrash fire statistic to the SRP formula yields the following probabilities:

Area A - Diesel Generator Bldg. Vents .....3.6×10^{-9} per year
Area B - Auxiliary Bldg. Vents.....2.7×10^{-9} per year
Area C - Crib House Intake Vents.....7.1×10^{-9} per year

These probabilities are in close agreement to the values calculated earlier in this report (Section 6.0).

6.3 Actual Waukegan Regional Airport Accident History.

Appendix 6 includes briefs of all of the accidents that occurred near WRA from 1964 through 1987. Table 6 shows a summary of these data. For this period, only five fatal and serious accidents had occurred. Of these five accidents, only 1 accident had occurred within the 3 to 4 mile radius of WRA. This accident rate at WRA can be used to compare the actual accident history at WRA to the model developed in this report.

The total number of operations at WRA for the years 1964 through 1987 can be estimated by using the base year operations per year number for 1988 and an operation per year estimate for 1964. A value of 36,000 operations per year for

1964 will be used.[26] By assuming annualized growth between these two figures, the total number of operations can be estimated as 1,521,446. The one accident in the 3 to 4 mile radius divided by the total number of operations during this period yields and accident rate per operation for this area of 6.57×10^{-7}. This compares closely with the accident rate per operation value of 1.49×10^{-7} as calculated in Section 4.5. Although the accident rate is low, this comparison does reveal that the analytical model as developed does predict an accident rate of the same order of magnitude as actual accident history.

Table 6

Summary of Aircraft Accidents at Waukegan
Regional Airport
1964 through 1987

Date	Aircraft Damage	Type of Accident			Postcrash Fire	Location (relative to WRA)
		Fatal	Serious	Minor		
09/27/64	Substantial			X		
02/21/65	Substantial			X		
03/22/65	Substantial			X		
02/01/66	Destroyed		X			on runway
03/11/66	Substantial			X		
07/15/66	Substantial			X		
10/10/66	Substantial			X		
11/28/67	Substantial			X		
09/08/67	Substantial			X		
12/31/67	Substantial			X		
05/12/68	Substantial			X		
10/26/68	Destroyed		X			near runway
01/25/69	Substantial			X		
03/05/69	Substantial			X		
04/07/70	Substantial			X		
08/12/70	Destroyed			X	Yes	on runway
06/03/71	Substantial			X		
09/13/71	Substantial			X		
03/15/72	Substantial		X			1/3 mile
05/03/74	Substantial			X		
08/17/74	Substantial			X		
09/25/74	Substantial			X		
09/11/76	Substantial			X		
11/11/78	Substantial			X		
12/16/78	Destroyed	X			Yes	on airport
01/19/79	Substantial			X		
01/16/80	Destroyed	X			Yes	3.5 miles
05/27/80	Substantial			X		
07/16/80	Substantial			X		
09/16/80	Substantial			X		
01/02/81	Substantial			X		
04/05/82	Minor			X		
03/14/83	Substantial			X		
06/12/83	Substantial			X		
01/14/84	Substantial			X		
11/23/84	Substantial			X		
05/12/86	Substantial			X		
06/20/87	Substantial			X		
	TOTAL	2	3	33	3	

7.0 Qualitative Evaluation

The following evaluations are very important for an understanding of the probability of a postcrash fire affecting the air intake vents, but they cannot be put into quantitative terms.

7.1 Increased Aircraft Operation Numbers Due to Training Exercises (Touch and Go Operations).

As outlined in Section 3.1, the local traffic at WRA is approximately 50% of the total operations. Much of this traffic is made up of general aviation single engine training operations. These training operations concentrate on landings and take-offs usually in succession, and are called touch and go's. These operations are counted twice in the operation numbers, once for a take-off and once for a landing.

Airport flight track studies performed for the Part 150 Airport Noise Compatibility Study showed that these training flights tend to stay very near the airport (within 1 mile) making tight turns to practice as often as possible since students want to maximize training during a limited amount of time.[21] Flight tracks of these operations made from in-field studies show the concentration of these flights near the airport. This is clearly shown on Figure 1 in Appendix 4.

These flight tracks reveal that many of the local operations do not travel away from the airport to the vicinity of ZNPS. The actual number of operations that come near, or pass the 3 mile distance to ZNPS would be only a small percentage of the operations labeled as local.

7.1 Traffic Flight Tracks - Right and Left Hand Traffic Patterns.

Flight tracks were also produced for arrivals and departures for WRA for the Part 150 Airport Noise Compatibility Study. These flight tracks are shown in Figure 2 & 3 in Appendix 4. These flight tracks represent the majority of flights and are based on 1986 observations.(4)

Figure 2 in Appendix 4 shows the directions that most of the aircraft are recommended to take upon departure, unless a strong directional preference or wind conditions override these directions. The two flight tracks labeled J1 and J2 represent the tighter turning radius of the smaller general aviation aircraft, and the flight tracks labeled G1 and G2 show the wider turning radius of the larger Gulfstream G1/G2 jets. This preferred routing tends to move the aircraft away from more populated areas such as the city of Zion and, consequently, away from ZNPS.

Figure 3 in Appendix 4 shows the flight tracks used for arrivals. This figure shows that all of the runways are left hand traffic patterns. This refers to the direction an arriving aircraft will turn to approach the runway. Since this report has been finished, runway 23 has been changed to a right hand traffic pattern. Conversations with tower personnel indicate that aircraft are indeed following this traffic pattern.(5)

These traffic flight patterns indicate preferred directions are being followed and that there is a tendency for directing aircraft activity in an orderly fashion. This directing activity will also be increased since the tower commenced operation on October 1, 1988. Personnel communications and a visit to the control tower verified that tower

controllers are requesting departing and arriving traffic to follow traffic patterns. Specifically, on runway 23, traffic is recommended to turn right or left after take-off.[5] These procedures and traffic patterns tend to direct the majority of the aircraft traffic away from ZNPS.

As outlined earlier in Section 1.2, current traffic patterns are also due to the proximity of the O'Hare Terminal Area Control to the Wisconsin-Milwaukee Terminal Control Area. Aircraft departing WRA will choose to stay in the O'Hare Terminal Area Control, unless their intended destination is north. This proximity additionally causes the majority of traffic departing WRA to turn soon after take-off. The end result is that the majority of air traffic tends not to stay on a straight line course after take-off and therefore does not come into ZNPS airspace.

7.3 Physical plant design and trajectories.

The physical design of the intake vents along with their placement serve to reduce the postcrash probability. Three of the four areas are blocked from many approach angles by either the containment buildings or other structures. Ledges, grading, and roof lips of at least 6" are permanent parts of the building design and would serve to route fuel away from the vent openings.

Photograph 1 in Appendix 5 is an overall view of ZNPS looking Southwest. The ventilation target areas are labeled.

Photograph 2 shows Area A of Unit 1 air intakes taken from ground level. Area A of the Unit 2 diesel generator intakes is similar to this area. The approach trajectories to these intake vents would be only from the southwest,

thereby limiting an air crash from WRA to a departure. An aircraft on arrival to WRA runway 23 would, first, be 3/4 of a mile off of a straight line approach to the runway and, secondly, if approaching ZNPS, the target area would be protected by the turbine building and auxiliary building. This shielding effect of the building from an arrival to WRA serves to halve the listed probability of a plane hitting the diesel intake vents, since a good estimate is that the number of arrivals and departures is roughly equal. The crash probabilities would be additionally lowered for these intake vents since, as was shown in Section 7.2, that departing aircraft are requested to make quick turns after take-off.

Photograph 3 shows Area B, the auxiliary building ventilation intake located on the north side of the Auxiliary building. A similar argument can also be made that due to the fact that the target area faces Northeast, the approaching plane would have to be from an arrival rather than a departure from WRA. Again, assuming an equal number of arrivals and departures, limiting the crash probability to only an aircraft on arrival to WRA would serve to reduce the crash probability by one half.

Photograph 4 shows Area C, the crib house service water pump area ventilation intakes, looking North. The clearest approach trajectory to this area would be from an arriving aircraft intending to use runway 23 for a landing. As indicated above and in Section 7.4 below, an aircraft would be 3/4 of a mile off of a straight line course to the runway. A crash approach from a departing aircraft that continued relatively straight after take-off (rather than turning as usual) would be obstructed from hitting the crib house service water pump ventilation intakes by Unit 1 and Unit 2 containment, in addition to being obstructed by the turbine building.

Limiting the crash probability to an arriving aircraft to WRA would also serve to halve the listed crash probability.

7.4 Instrument Landing Approaches to Runway 23.

Instrument landings can be made at WRA on runway 23 using the ILS (Instrument Landing System). These instrument landings would be used mainly by the larger aircraft, such as the corporate/business jets. The use of this system tends to keep the aircraft away from ZNPS.

Aircraft that will utilize the ILS system will be homing in on the signal generated by radio beacons located on a straight line from the runway. There are two beacons located along the runway heading of 230 degrees (230 degrees magnetic North, 229 degrees instrument heading) at approximately 1 and 4 miles from the end of the runway.

The farthest beacon is called the Final Approach Fix Marker. This beacon is located on the south side of 17th Street, approximately 1000 feet from the beach and 1 1/4 miles north of ZNPS. Aircraft intending to make an instrument landing using ILS must be on a final approach and on a straight line course at this point. The aircraft would not be turning in for this approach in any other way. On this flight heading, the closest approach to ZNPS would be approximately 3/4 miles. This approach and the location of the Final Approach Fix Marker can be seen on Figure 1.

7.5 Development of the Postcrash Fire Statistics.

Additional conservatism is built into the analytical model by the inclusion of serious aircraft accidents. Whereas the SRP model only includes fatal accidents, the model presented here includes both fatal and serious accidents since both categories of accidents can cause postcrash fires.

The data used to create the postcrash fire statistics involved general aviation accidents throughout the United States including Alaska and Hawaii. It is known that different regions have different accident rates. In general, midwest flying is typically safer than that of other regions due to the lack of mountainous terrain and adverse weather patterns. Accident data obtained from the U.S. Department of Transportation confirm this view.[25] These data are shown in Table 7 below:

Table 7

Regional Differences in General Aviation Accident Rates
Averaged for the years 1980-1986

Data sorted by Best to Worst Region on Total Accident Rate

	Total Accidents (per 100,000 flight hours)	Fatal Accidents (per 100,000 flight hours)
Eastern Region	8.04	1.46
Great Lakes Region	8.18	1.25
Southern Region	8.39	1.64
Southwest Region	8.51	1.53
Western Pacific	8.98	1.97
New England Region	9.49	1.49
Central Region	10.74	1.54
Northwest Mountain Region	12.76	2.60
Alaska Region	22.70	2.75

Table 7

Regional Differences in General Aviation Accident Rates
Averaged for the years 1980-1986

Data sorted by Best to Worst Region on Fatal Accident Rate

	Total Accidents (per 100,000 flight hours)	Fatal Accidents (per 100,000 flight hours)
Great Lakes Region	8.18	1.25
Eastern Region	8.04	1.46
New England Region	9.49	1.49
Southwest Region	8.51	1.53
Central Region	10.74	1.54
Southern Region	8.39	1.64
Western Pacific	8.98	1.97
Northwest Mountain Region	12.76	2.60
Alaska Region	22.70	2.75

As can be seen from Table 7, Great Lakes flying tends to have a lower accident rate than other regions. Therefore, since midwest flying tends to have a lower accident rate, crash statistics created from a database compiled of all regions will tend to overestimate the accident rate for midwest flying.

7.6 Fuel Loading and Fuel Spill Areas.

There are several features in the analytical model which tend to introduce additional safety factors into the calculated probabilities. The first factor of safety involves the postulated aircraft involved in the accident. An assumption was made that the plane was fully loaded with fuel. Operation numbers from WRJ show that the number of take-offs and landings are approximately equal. It would be expected that landing aircraft from itinerant operations would have less than a full tank of fuel.

A safety factor is also included in the model by the large (20 ft. radius) area of flame or fume damage assumed around the aircraft impact site. This area represents the worst case of the fuel tank leaking all of its contents with sufficient time for the fuel to spread, before ignition. Case histories of postcrash fires indicate that ignition upon impact is extremely rapid.[22] This implies that in most cases the fuel does not spread far from the impact area.

The fuel spread and damage area for corporate/business jet traffic was also estimated conservatively. The target areas used were twice the areas of the general aviation aircraft. This increase more than accounts for twice the amount of fuel and a much larger possible damage area.

8.0 Future General Aviation Activity at WRA.

8.1 Increase in Traffic Activity at WRA Through the Year 2000 and Its Effects on the Postcrash Fire Probabilities.

Actual FAA Terminal Area Forecasts for Illinois predict an average annual growth rate of 2% for general aviation operations for the years 1988 through 2000.[23] Specific FAA forecasts for WRA predict a slightly higher rate of general aviation growth. Current predictions see WRA general aviation operations growing at an average annualized rate of 4.8% per year for the years 1988 through 2005.[24] Given the current operations numbers of WRA of 106,063, it would take approximately 15 years for the number of operations to double. At that time (year 2003) assuming similar crash statistics, the general aviation crash probabilities would also double.

Corporate/business jet operations are expected to grow at a faster rate due to the lengthened runway, control tower, Instrument Landing System, and other improvements. These improvements will make the use of the airport for corporate/business jet traffic more attractive. The Part 150 Airport Noise Compatibility Study predicts jet traffic to more than double by the year 1991.[10] After this brief period of high growth, corporate/business jet operations should be expected to fall off and increase with the general rate of the airport. Using these assumptions, corporate/business jet crash probabilities would be approximately 6 times greater in the year 2008.

8.2 Future Developments At WRA.

The Airport Layout Plan Report currently in effect for WRA proposes the lengthening of runway 5/23 to 8000 feet total. This action would require the relocation of Green Bay Road. Conversations with airport officials and individuals involved with the new Airport Layout Plan indicate that the lengthening of the runway is not a high probability. Airport officials have even gone on record stating that this improvement will not be pursued. Green Bay Road is currently a two lane highway at this point. The Illinois Department of Transportation has plans to turn this stretch of highway into a four lane highway. If this action is completed, it would be even more unlikely that the runway expansion would be completed.

The new Airport Layout Plan Report that is being developed does have provisions for a trainer runway to be built parallel to runway 5/23. This shorter runway would be used for small general aviation aircraft exclusively, and also for the frequent training and touch and go operations. If approved, preliminary estimates are that this parallel trainer runway could be in place by early 1992. This airport improvement will create a safer airport by separating local and itinerant traffic, and training aircraft operations. Currently training is being performed on the same runway that is also handling the operations of the larger corporate jet aircraft.

Although this airport improvement is likely to increase total aircraft operations, it will increase this number by increasing local, touch and go, and trainer operations, not itinerant operations. It is these local training operations, as shown in Section 7.1, that tend not to venture near the airspace around ZNPS.

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9. Waukegan Regional Airport - Daily Airport Traffic Record, FAA Form 7230-1, for the months of October and November 1988, obtained from airport officials. (See Appendix 1.)

10. Reference 2, Table 7, page 40.

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15. Requested Database Search performed by: Carol Floyd, Aviation Accident Data Office, Safety Studies and Analysis Division, Bureau of Safety programs, National Transportation Safety Board. Requested search on June 25, 1985 and December 3, 1988. (See Appendix 3.)

16. Industrial Fire Hazards Handbook, 2nd ed., p. 770.

17. Fire Protection Handbook, 15th ed., National Fire Protection Association, p. 4-33.

18. Part 150 - Airport Noise Compatibility Planning Part II Report Noise Compatibility Program - Waukegan Regional Airport. Revised October 1988. Performed by: William J. Murray & Associates, Inc. Springfield, Illinois, pages 35-36.

19. D.G. Eisenhut, "Reactor Siting in the Vicinity of Airfields." Paper presented at the American Nuclear Society Annual Meeting, June 1973.

20. Reference 16, page 49.

21. Reference 2, page 42./

22. "General Aviation Accidents: Postcrash Fires and How to Prevent or Control Them," National Transportation Safety Board Special Study, Publication Number: PB81-102071, page 8.

23. Reference 1, Table 35. (See Appendix 2.)

24. FAA Terminal Area Forecast FY 1989 through 2000 U. S. Department of Transportation. Waukegan Regional Airport (See Appendix 2) - Preliminary Data.

25. Data obtained from Sarah Hodges-Austin, FAA Statistics officer, U.S.Department of Transportation. Washington D.C. - Draft Report Data.

26. Reference 2, page 38.

APPENDIX 1

FAA Airport Master Record (Form 5010-1)
Waukegan Regional Airport
(12 months ending November 30, 1986)

Daily Airport Traffic Record
October 1988
November 1988

8/24/87

COUNTY: L[illegible]

[illegible] AERO CHT: CHICAGO

>10 OWNERSHIP: PUBLIC	>78 FUEL: 100 MOGAS A	90 SINGLE ENG:	191
>11 OWNER: WAUKEGAN PORT DISTRICT	>71 AIRFRAME RPRS: MAJOR	91 MULTI ENG:	51
>12 ADDRESS: PO BOX 429	>72 PWR PLANT RPRS: MAJOR	92 JET:	17
WAUKEGAN IL 60079	>73 BOTTLE OXYGEN: HIGH	TOTAL	259
>13 PHONE NR: 312-244-3133	>74 BULK OXYGEN:		
>14 MANAGER: PATRICK NOLAN	75 TSNT STORAGE: TIE HGR	93 HELICOPTERS:	7
>15 ADDRESS: P O BOX 429	76 OTHER SERVICES: CHTR	94 GLIDERS:	
WAUKEGAN IL 60079	RNTL SALES INSTR	95 MILITARY:	
>16 PHONE NR: 312-244-8855		96 ULTRA-LIGHT:	
>17 ATTENDANCE SCHEDULE:			
MONTHS ALL / DAYS ALL / HOURS ALL			

18 AIRPORT USE: PUBLIC	>80 ARPT BCN: CG	100 AIR CARRIER:	
19 ARPT LAT: 42-25-17N ESTIMATED	>81 APT LGT SKED: SUNSET-SUNRISE	101 COMMUTER:	
20 ARPT LONG: 087-52-08W	>82 UNICOM: 123.000	102 AIR TAXI:	1284
21 ARPT-ELEV: 00727 ESTIMATED	>83 WIND INDICATOR: YES	103 G A LOCAL:	74338
22 ACREAGE: 600	84 SEGMENTED CIRCLE: NONE	104 G A ITNRNT:	54796
>23 RIGHT TRAFFIC: NO	85 CONTROL TWR: NO	105 MILITARY:	100
>24 NON-COMM LANDING FEE: YES	86 FSS: KANKAKEE	TOTAL:	130438
25 NASP/FEDERAL AGREEMENT: NGY	87 FSS ON ARPT: YES		
26 FAR 139 INDEX: N	88 FSS PHONE NR: 815-935-5871	OPERATIONS FOR 12	
	89 TOLL FREE NR: 1-800-322-5552	MOS ENDING 30NOV86	

RUNWAY DATA

	05/23	14/32			
>30 RUNWAY IDENT	05/23	14/32			
>31 LENGTH:	6000	3750			
>32 WIDTH:	150	75			
>33 SURF TYPE-COND	CONC-G	CONC-G			
>34 SURF TREATMENT					
35 GROSS WT: SW	95	16			
36 (IN THSDS) DW	128	23			
37 DTW	290				
38 DDTW					

LIGHTING/APCH AIDS

	05/23	14/32			
>40 EDGE INTENSITY	HIGH	MED			
41 NOW ELEMENT 81					
>42 RWY MARK TYPE-COND	NPI-G /API-G	BSC-F /BSC-F	/	/	/
>43 VASI	VAL /VAL	VAL /N	/	/	/
44 THR CROSSING HGT	37 /38	38 /	/	/	/
45 VISUAL GLIDE ANGLE	3.00 /3.00	3.50 /	/	/	/
>46 CNTRLN-TDZ	N-N /N-N	N-N /N-N	/	/	/
>47 RVR-RVV	N-N /N-N	N-N /N-N	/	/	/
>48 REIL	Y /	N /N	/	/	/
>49 APCH LIGHTS	/	/	/	/	/

OBSTRUCTION DATA

	05/23	14/32			
50 FAR 77 CATEGORY	B(V) /C	B(V) /B(V)	/	/	/
>51 DISPLACED THR	/	500 /	/	/	/
>52 CTLG OBSTN	TREE /	ROAD /TREE	/	/	/
>53 OBSTN MARKED/LGTD	/	/	/	/	/
>54 HGT ABOVE RWY END	39 /	15 /38	/	/	/
>55 DIST FROM RWY END	600 /	285 /1250	/	/	/
>56 CNTRLN OFFSET	506L /	125R /65L	/	/	/
57 OBSTN CLNC SLOPE	10:1 /50:1	40:1 /35:1	/	/	/
58 CLOSE-IN OBSTN	N /N	N /N	/	/	/

20:1 LANDING LENGTH

	05/23	14/32			
60 LANDING RWY-LENGTH	/	/	/	/	/
61 CTLG OBSTACLE	/	/	/	/	/
62 HGT-ABOVE THR	/	/	/	/	/
63 DIST FROM THR	/	/	/	/	/
64 CNTRLN OFFSET	/	/	/	/	/

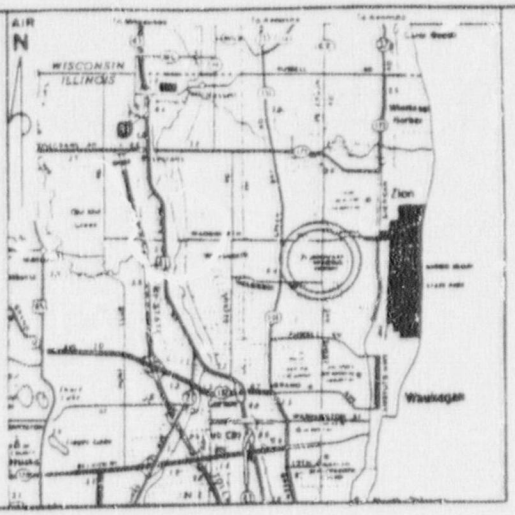
(>) ARPT MGR PLEASE ADVISE FSS IN ITEM 86 WHEN CHANGES OCCUR TO ITEMS PRECEDED BY >

>110 REMARKS:
APT57 RWY 14 APCH RATIO 20:1 AT DSPLCD THR TO TREES.
APR81 ACTVT HIRL 5/23 REIL S & MIRL 14/32 - 123.0.
APR2 FREQ 122.85 AVBL ON REQ.
A110 -R1 CTN: MIGRATORY BIRDS ON & IN VCNTY OF ARPT.
A110 -R2 RWY 05 REIL OTS INDEF.

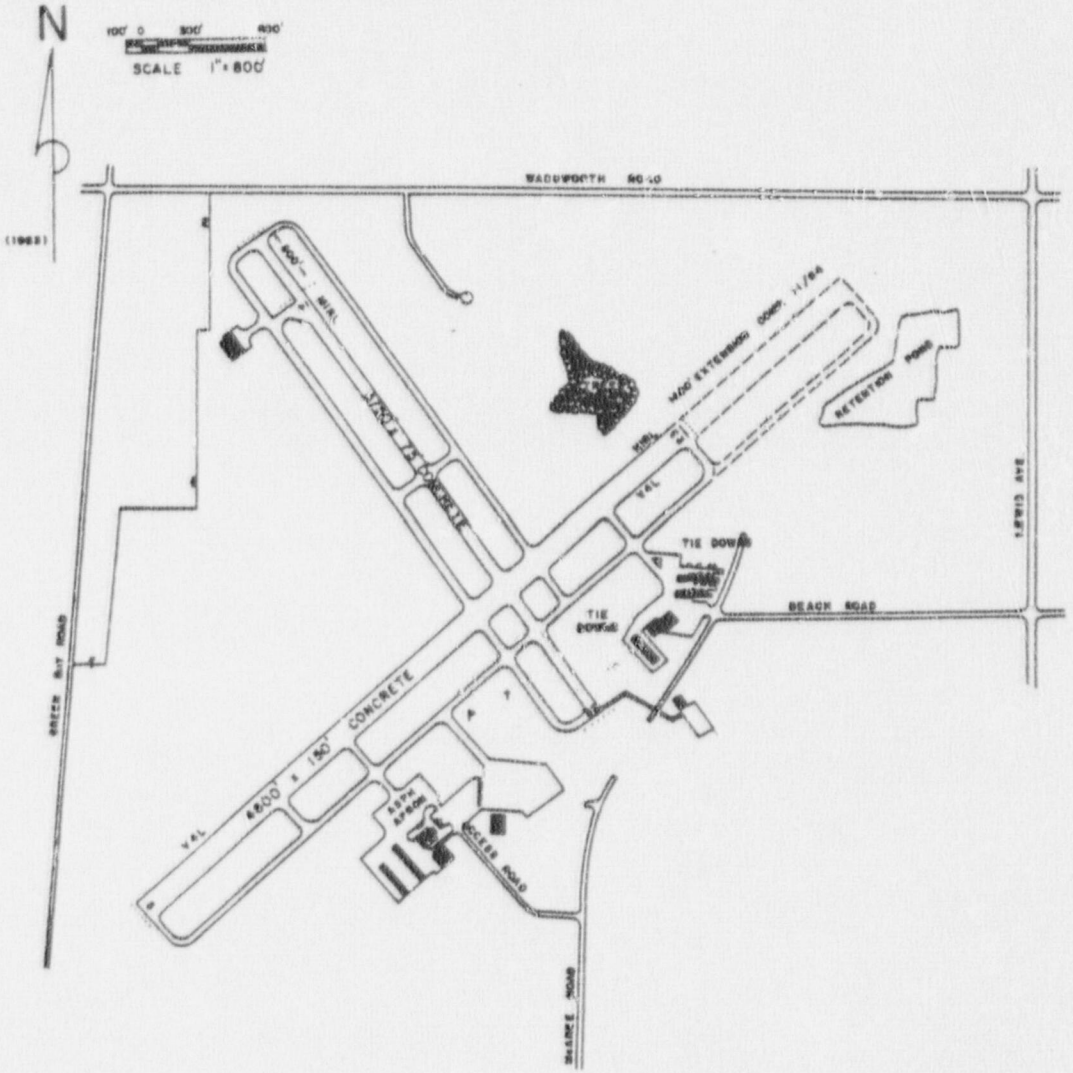
111 INSPECTOR: (S) 112 LAST INSP: 30NOV86 113 LAST INFO REQ:

NAME	WAUKEGAN MEMORIAL					SN 05052.A
RUNWAY	05	23	14	32		
EXISTING						
PLANNED						
CORRECTED LENGTH						
AIRPORT ACREAGE						
NOTES:						

AIR



AIRPORT LAYOUT



FAA FORM 5010-1 (5/74)

Users: All ATCTs

AIRPORT TRAFFIC RECORD

Mail ORIGINAL of this form to: Washington Office, AMS-420 thru Regional Air Traffic Division

Facility Name	Location	(1-2) Mo.	(3-4) Yr.	(5-9) Location Ident
WAUKEGAN ATCT	WAUKEGAN, ILLINOIS	10	88	UGN IL

(10-1) Facility Type ("X" one)

(11) Approach Control Towers
- ☐ B. Radar
- ☐ C. Limited Radar
- ☐ D. Non-Radar

→ (Also submit FAA Form 7230-26)

- ☐ E. VFR Tower
- ☒ G. Contract Tower

(Continue on Reverse)

Facility Type Changed: (12) ☐ Yes

If daily hours of operation have changed, enter new hours. Hrs. (77-78) 10ths (79)

Airport Operations Count

Day (15-16)	ITINERANT AC (17-21)	ITINERANT AT (22-26)	ITINERANT GA (27-31)	ITINERANT MI (32-36)	ITINERANT Total Itinerant	LOCAL Civil (37-41)	LOCAL Military (42-46)	LOCAL Total Local	Total Operations	Special Use (47-51)
1	0	2	55	0	57	38	0	38	95	Sat
2	0	0	176	0	176	233	0	233	409	
3	0	0	221	0	221	252	0	252	473	
4	0	0	122	0	122	86	0	86	208	
5	0	0	183	0	183	215	0	215	398	
6	0	0	194	2	196	175	0	175	371	
7	0	0	194	0	194	221	0	221	415	[illegible]
8	0	2	219	2	223	279	0	279	502	Sat
9	0	0	172	0	172	266	0	266	438	
10	0	5	75	0	80	60	0	60	140	
11	0	0	126	0	126	114	0	114	240	
12	0	0	225	13	238	161	0	161	399	
13	0	0	156	0	156	158	0	158	314	[illegible]
14	0	1	126	0	127	82	0	82	209	
15	0	0	240	2	242	224	0	224	466	Sat
16	0	0	136	0	136	164	0	164	300	
17	0	1	49	0	50	32	0	32	82	
18	0	0	138	0	138	110	0	110	248	
19	0	4	175	0	179	243	0	243	422	
20	0	8	102	2	112	228	0	228	340	
21	0	1	88	0	89	96	0	96	185	[illegible]
22	0	1	254	0	255	246	0	246	501	Sat
23	0	0	33	0	33	6	0	6	39	
24	0	0	52	0	52	18	0	18	70	
25	0	2	106	0	108	48	0	48	156	
26	0	2	195	2	199	133	6	139	338	
27	0	0	106	0	106	4	0	4	110	
28	0	2	112	0	114	43	0	43	157	
29	0	1	233	0	234	387	0	387	621	Sat
30	0	0	187	0	187	184	0	184	371	
31	0	0	87	2	89	154	4	158	247	
Total	0	32	4537	25	4594	4660	10	4670	9264	

Users: All ATCT's

AIRPORT TRAFFIC RECORD

Mail ORIGINAL of this form to Washington Office, AMS-420 thru Regional Air Traffic Division

Facility Name	Location	(1-2) Mo.	(3-4) Yr.	(5-9) Location Ident
WAUKEGAN ATCT	WAUKEGAN, ILLINOIS	11	85	UGAI IL

(10-1) Facility Type ("X" one)

(11) Approach Control Towers
- ☐ B. Radar
- ☐ C. Limited Radar
- ☐ D. Non-Radar

→ (Also submit FAA Form 7230-26)

- ☐ E. VFR Tower
- ☒ G. Contract Tower

(Continue on Reverse)

Facility Type Changed: (12) ☐ Yes

If daily hours of operation have changed, enter new hours: Hrs. (77-78) 10ths (79)

Airport Operations Count

Day (15-16)	ITINERANT AC (17-21)	ITINERANT AT (22-26)	ITINERANT GA (27-31)	ITINERANT MI (32-36)	ITINERANT Total Itinerant	LOCAL Civil (37-41)	LOCAL Military (42-46)	LOCAL Total Local	Total Operations	Special Use (47-51)
1			165		165	238		238	403	
2			184		184	193		193	377	
3		2	157	4	163	228		228	391	
4			21		21				21	
5			18		18				18	
6			15		15				15	
7		2	145		147	218		218	365	
8			148		148	262		262	410	
9			101		101	209		209	310	
10		2	84	2	88	54	2	56	144	
11		4	215		219	293		293	512	
12			38		38				38	
13		1	234		235	178		178	413	
14		2	147		149	204		204	353	
15		1	72		73	54		54	127	
16		4	45		49	2		2	51	
17			139	4	143	229		229	372	
18		2	173		175	175	12	187	362	
19			36		36				36	
20		4	39	6	49	61	1	62	111	
21			134		134	182		182	316	
22		2	216		218	199		199	417	
23		3	162		165	199	2	201	366	
24			148		148	60		60	208	
25			232		232	261		261	493	
26			17	2	19	6		6	25	
27		4	38		42	18		18	60	
28			76		76	46	14	60	136	
29			129		129	90		90	219	
30			33		33	24	4	28	61	
31										
Total		33	3361	18	3412	3683	35	3718	7130	

FAA Form 7230-1 (4-85)

RIS: AT 7230-99

APPENDIX 2

Total General Aviation Operations
(National Summary by Region, 1976 - 1995)

Total General Aviation Operations
(Great Lakes Summary by State, 1982 - 2000)

Waukegan Regional Airport
Total Operations Forecast, 1988-2005

TABLE 12

GENERAL AVIATION TOTAL OPERATIONS
NATIONAL SUMMARY BY REGION, 1976-1995

FISCAL YEAR	ALASKA	CENTRAL	EASTERN	GREAT LAKES	NEW ENGLAND	NORTHWEST MOUNTAIN	SOUTHERN	SOUTHWEST	WESTERN-PACIFIC	TOTAL
					TOTAL OPERATIONS IN MILLIONS*					
HISTORICAL										
1976	1.6	5.9	13.1	19.6	4.6	10.4	16.3	12.6	17.7	101.9
1977	1.5	6.1	13.5	20.3	4.7	11.0	16.9	13.2	19.1	106.4
1978	1.8	6.6	14.1	20.8	4.8	11.7	18.2	14.7	20.6	113.3
1979	1.6	6.8	14.6	21.5	4.9	12.2	19.1	15.5	21.3	117.6
1980	1.7	7.8	15.9	21.8	5.1	12.2	18.8	16.4	21.6	121.2
1981	1.8	7.6	15.1	20.8	4.9	12.0	19.2	17.2	20.6	119.1
1982	1.7	7.0	14.6	18.8	4.2	11.2	17.8	17.5	18.4	111.1
1983	1.7	6.8	15.2	18.2	4.9	11.5	17.6	17.0	17.8	110.7
FORECAST										
1984	1.8	7.1	15.6	18.8	5.2	11.7	18.3	17.8	18.8	115.1
1985	1.9	7.4	16.2	19.7	5.4	12.3	19.4	18.7	19.7	120.6
1986	2.0	7.7	16.8	20.3	5.6	12.7	20.1	19.4	20.3	125.0
1987	2.0	8.0	17.5	20.9	5.7	13.2	20.9	20.2	21.0	129.5
1988	2.1	8.2	18.1	21.5	5.9	13.7	21.7	21.0	21.7	134.0
1989	2.2	8.6	18.5	22.2	6.1	14.2	22.5	21.7	22.4	138.2
1990	2.3	8.9	18.9	22.7	6.2	14.7	23.2	22.4	23.0	142.2
1991	2.4	9.1	19.2	23.3	6.3	15.3	23.9	23.0	23.7	146.1
1992	2.4	9.4	19.7	23.8	6.4	15.8	24.6	23.8	24.4	150.4
1993	2.5	9.7	20.1	24.4	6.5	16.2	25.4	24.5	25.1	154.5
1994	2.6	10.0	20.5	25.0	6.7	16.8	26.2	25.3	25.8	158.8
1995	2.7	10.3	20.9	25.6	6.8	17.3	27.0	26.0	26.6	163.2

*INCLUDES GENERAL AVIATION AIRCRAFT OPERATIONS AT APPROXIMATELY 4,000 AIRPORTS IN THE TERMINAL AREA FORECAST DATA BASE.

TABLE 35

TOTAL AIRCRAFT OPERATIONS
GREAT LAKES SUMMARY BY STATE, 1982-2000

FISCAL YEAR	ILLINOIS	INDIANA	MICHIGAN	MINNESOTA	NORTH DAKOTA	OHIO	SOUTH DAKOTA	WISCONSIN
				TOTAL OPERATIONS IN THOUSANDS*				
HISTORICAL								
1982	2,247	684	1,508	727	391	1,295	135	787
1983	2,372	647	1,627	826	391	1,316	154	797
1984	2,476	731	1,740	861	401	1,338	149	810
1985	2,618	750	1,879	902	418	1,364	155	805
1986	2,671	761	2,009	970	428	1,391	141	853
FORECAST								
1987	2,772	841	2,086	1,014	424	1,506	158	882
1988	2,875	899	2,151	1,042	438	1,562	165	933
1989	2,943	935	2,220	1,053	448	1,602	172	967
1990	3,008	971	2,289	1,083	456	1,640	179	997
1991	3,076	1,013	2,339	1,098	464	1,672	185	1,025
1992	3,144	1,044	2,385	1,113	472	1,704	191	1,052
1993	3,212	1,075	2,431	1,128	481	1,735	197	1,079
1994	3,280	1,106	2,477	1,143	489	1,767	203	1,107
1995	3,350	1,135	2,523	1,158	497	1,799	210	1,134
1996	3,415	1,165	2,571	1,173	504	1,831	216	1,162
1997	3,481	1,195	2,620	1,188	513	1,862	222	1,189
1998	3,547	1,225	2,669	1,203	521	1,894	228	1,217
1999	3,614	1,256	2,717	1,218	529	1,925	235	1,245
2000	3,681	1,286	2,766	1,233	537	1,957	241	1,273

*FORECASTED TOTAL OPERATIONS BASED ON THE NUMBER OF TOWERS AS OF SEPTEMBER 1987.

REGION-STATE: AGL-IL LOCID: UGN NONTOWERED
CITY: WAUKEGAN AIRPORT: WAUKEGAN REGIONAL BASED AIRCRAFT: 201

	(---ENPLANEMENTS (000)---)				(----------AIRCRAFT OPERATIONS (000)----------)								
					(----------ITINERANT----------)				(-----LOCAL-----)				
YEAR	AIR CARR.	AIR TAXI	COMM.	TOTAL	AIR CARR.	AT + COMM.	GA	MIL	TOTAL	GA	MIL.	TOTAL	TOTAL OPS.	INST. OPS. (000)
ACTUAL														
1976						1	28	2	31	92	2	94	125	
1977		0		0			33	2	74	92	2	94	129	
1978		2		2		2	38	2	41	121	2	123	165	
1979		2		2		2	43	2	46	117	2	119	165	
1980		2		2		2	47	2	51	153	2	155	206	
1981		0		0		0	52	2	56	153	2	155	211	
1982		0		0		2	57	2	61	153	2	155	216	
1983		0		0		2	62	2	66	76	2	78	144	
1984		0		0		2	67	2	71	159	2	161	231	
1985		0		0		1	72	0	73	72		72	145	
1986		0		0		1	77	0	78	52		52	130	
1987		0		0		1	55	0	56	74		74	130	
FORECAST														
1988		0		0		1	59	0	60	80		80	141	
1989		0		0		1	63	0	65	86		86	151	
1990		0		0		1	68	0	69	92		92	161	
1991		0		0		1	72	0	74	98		98	171	
1992		0		0		1	76	0	78	103		103	181	
1993		0		0		1	81	0	82	109		109	191	
1994		0		0		1	85	0	87	115		115	202	
1995		0		0		2	89	0	91	121		121	212	
1996		0		0		2	94	0	95	127		127	222	
1997		0		0		2	98	0	100	133		133	232	
1998		0		0		2	102	0	104	138		138	242	
1999		0		0		2	107	0	108	144		144	253	
2000		0		0		2	111	0	113	150		150	263	
2001		0		0		2	115	0	117	156		156	273	
2002		0		0		2	120	0	121	162		162	283	
2003		0		0		2	124	0	126	167		167	293	
2004		0		0		2	128	0	130	173		173	304	
2005		0		0		2	132	0	135	179		179	314	

COMMENTS: CHICAGO HUB AREA FORECASTS. RELIEVER FOR ORD.

APPENDIX 3

Fatal and Serious Accident Data

Postcrash Fire Data

Years 1977 thru 1985

ANALYTIC TABLE

FATAL ACCIDENTS
U.S. GENERAL AVIATION
1977 - 1981

AIRPORT PROXIMITY BY YEAR OF OCCURRENCE
TRA 23

TRA 155	NONE	77	78	79	80	81	OTHER	RECORDS	ACCIDENTS	PERCENT
NONE										
ON AIRPORT		68	82	73	67	66		356	340	10.60
ON SEAPLANE BASE		1	1	1				3	3	.09
ON HELIPORT					1			1	1	.03
ON BARGE/SHIP/PLATFORM					2			2	2	.06
IN TRAFFIC PATTERN		43	21	19	26	26		135	129	4.02
WITHIN 1/4 MILE		42	57	39	53	35		226	220	6.73
WITHIN 1/2 MILE		34	29	38	25	36		162	159	4.82
WITHIN 3/4 MILE		12	10	10	10	10		52	52	1.55
WITHIN 1 MILE		24	19	23	30	21		117	114	3.48
WITHIN 2 MILES		39	48	37	31	46		201	196	5.98
WITHIN 3 MILES		26	30	28	17	26		127	124	3.78
WITHIN 4 MILES		18	14	11	14	13		70	66	2.08
WITHIN 5 MILES		21	18	14	12	17		82	79	2.44
BEYOND 5 MILES		314	369	315	296	320		1614	1591	48.04
UNKNOWN/NOT REPORTED		36	44	35	50	47		212	211	6.31
OTHER										
RECORDS		678	742	643	634	663		3360		
ACCIDENTS		661	719	631	618	654			3283	
PERCENTS	.0	20.2	22.1	19.1	18.9	19.7	.0			

ANALYTIC TABLE

FIRE AFTER IMPACT ACCIDENTS
WITH FATAL INJURIES
U.S. GENERAL AVIATION
1977 - 1981

AIRPORT PROXIMITY BY YEAR OF OCCURRENCE
IRA 23

IRA 155	NONE	77	78	79	80	81	OTHER	RECORDS	ACCIDENTS	PERCENT
NONE										
ON AIRPORT		19	20	15	15	20		89	88	10.16
ON SEAPLANE BASE										
ON HELIPORT										
ON BARGE/SHIP/PLATFORM					1			1	1	.11
IN TRAFFIC PATTERN		14	5	6	9	8		42	42	4.79
WITHIN 1/4 MILE		13	16	13	13	17		72	71	8.22
WITHIN 1/2 MILE		8	7	9	12	10		46	4	5.25
WITHIN 3/4 MILE		4	3	2	3	3		15	,	1.71
WITHIN 1 MILE		5	3	8	8	6		30	30	3.42
WITHIN 2 MILES		8	16	11	8	15		58	57	6.62
WITHIN 3 MILES		8	8	11	6	9		42	41	4.79
WITHIN 4 MILES		7	8	5	3	3		26	26	2.97
WITHIN 5 MILES		6	5	3	3	3		20	20	2.28
BEYOND 5 MILES		81	81	79	68	95		404	403	46.12
UNKNOWN/NOT REPORTED		8	6	1	8	8		31	31	3.54
OTHER										
RECORDS		181	178	163	157	197		876		
ACCIDENTS		179	177	163	155	197			871	
PERCENTS	.0	20.7	20.3	18.6	17.9	22.5	.0			

ANALYTIC TABLE

SERIOUS ACCIDENTS
U.S. GENERAL AVIATION
1977 - 1981

AIRPORT PROXIMITY BY YEAR OF OCCURRENCE
IRA 23

IRA 155	NONE	77	78	79	80	81	OTHER	RECORDS	ACCIDENTS	PERCENT
NONE										
ON AIRPORT		111	124	95	115	93		538	528	27.39
ON SEAPLANE BASE			1					1	1	.05
ON HELIPORT		1	2		1	2		6	6	.31
ON BARGE/SHIP/PLATFORM										
IN TRAFFIC PATTERN		16	34	18	19	36		123	122	6.26
WITHIN 1/4 MILE		48	43	44	39	24		198	198	10.08
WITHIN 1/2 MILE		20	25	4	28	17		94	93	4.79
WITHIN 3/4 MILE		4	5	3	2			14	14	.71
WITHIN 1 MILE		16	11	15	12	18		72	72	3.67
WITHIN 2 MILES		15	15	18	23	20		91	91	4.63
WITHIN 3 MILES		11	9	12	10	10		52	52	2.65
WITHIN 4 MILES		5	6	4	7	9		31	31	1.58
WITHIN 5 MILES		1	5	3	2	7		18	18	.92
BEYOND 5 MILES		126	129	132	116	83		586	582	29.84
UNKNOWN/NOT REPORTED		30	23	27	27	33		140	140	7.13
OTHER										
RECORDS		404	432	375	401	352		1964		
ACCIDENTS		400	427	374	398	349			1948	
PERCENTS	.0	20.6	22.0	19.1	20.4	17.9	.0			

ANALYTIC TABLE

FIRE AFTER IMPACT ACCIDENTS
WITH SERIOUS INJURIES
U.S. GENERAL AVIATION
1977 - 1981

AIRPORT PROXIMITY BY YEAR OF OCCURRENCE
IRA 23

IRA 155	NONE 77	78	79	80	81	OTHER	RECORDS	ACCIDENTS	PERCENT
NONE									
ON AIRPORT	19	9	10	10	6		54	54	23.08
ON SEAPLANE BASE		1					1	1	.43
ON HELIPORT									
ON BARGE/SHIP/PLATFORM									
IN TRAFFIC PATTERN		2	1	3	3		9	9	3.85
WITHIN 1/4 MILE	6	6	7	5	4		28	28	11.97
WITHIN 1/2 MILE	1	3			2		6	6	2.56
WITHIN 3/4 MILE				1			1	1	.43
WITHIN 1 MILE	2			2	6		10	10	4.27
WITHIN 2 MILES	2	2	2	1	3		10	10	4.27
WITHIN 3 MILES			1				1	1	.43
WITHIN 4 MILES		1	1	2	2		6	6	2.56
WITHIN 5 MILES	1	1	2		1		5	5	2.14
BEYOND 5 MILES	21	17	22	8	12		80	79	34.19
UNKNOWN/NOT REPORTED	7	3	4	4	5		23	23	9.83
OTHER									
RECORDS	59	45	50	36	44		234		
ACCIDENTS	58	45	50	36	44			233	
PERCENTS	.0 25.2	19.2	21.4	15.4	18.8	.0			

U.S. General Aviation Accidents - 1982

Page 1

C220 ----

ALAPT

	Fatal	Ser-ious	Minor	None	Other	Total	Pct
On airport	53	83	152	1027	0	1315	40.2
On airstrip	3	12	18	125	1	159	4.9
Off airport/strip	13	5	10	37	0	65	2.0
Other	537	240	243	713	0	1733	52.9
Total	606	340	423	1902	1	3272	100.0
Percent	18.5	10.4	12.9	58.1	.0	100.0	

U.S. General Aviation Accidents - 1982
Fire After Impact

Page 1

C220 ----

ALAPT

	Fatal	Ser-ious	Minor	None	Total	Pct
On airport	13	9	9	23	54	17.6
On airstrip	1	3	2	5	11	3.6
Off airport/strip	2	0	0	2	4	1.3
Other	153	35	16	34	238	77.5
Total	169	47	27	64	307	100.0
Percent	55.0	15.3	8.8	20.8	100.0	

U.S. General Aviation Accidents - 1983

C204 ---->

C27

	None	Minor Ser	Fatal	Total	Pct
Off airport/airstrip	689	255	197	466	1607	51.7
On airport	925	130	93	65	1213	39.1
On airstrip	130	29	11	4	177	5.7
Other	47	18	18	26	109	3.5
Total	1791	432	322	561	3106	100.0
Percent	57.7	13.9	10.4	18.1	100.0	

U.S. General Aviation Accidents - 1983
Fire After Impact

C204 ---->

C27

	None	Minor Ser	Fatal	Total	Pct
Off airport/airstrip	23	13	18	115	169	72.5
On airport	27	1	6	21	55	23.6
On airstrip	2	1	0	0	3	1.3
Other	0	0	2	4	6	2.6
Total	52	15	26	140	233	100.0
Percent	22.3	6.4	11.2	60.1	100.0	

Page 1

U.S. General Aviation Accidents - 1984

0204 ---->

027

	None	Minor Ser	Fatal	Total	Pct
Off airport/airstrip	660	278	262	477	1677	55.0
On airport	844	132	64	50	1090	35.8
On airstrip	140	25	9	5	179	5.9
Other	50	14	13	24	101	3.3
Total	1694	449	348	556	3047	100.0
Percent	55.6	14.7	11.4	18.2	100.0	

Page 1

U.S. General Aviation Accidents - 1984
Fire After Impact

0204 ---->

027

	None	Minor	Ser	Fatal	Total	Pct
Off airport/airstrip	33	24	37	138	232	80.8
On airport	19	2	3	19	43	15.0
On airstrip	3	0	0	1	4	1.4
Other	3	0	1	4	8	2.8
Total	58	26	41	162	287	100.0
Percent	20.2	9.1	14.3	56.4	100.0	

U.S. General Aviation Accidents - 1985

C204 ---->

C27

	None	Minor Ser		Fatal	Total	Pct
Off airport/airstrip	649	240	227	442	1558	56.2
On airport	758	142	70	54	1024	37.0
On airstrip	129	24	6	6	165	6.0
Other	7	6	5	6	24	.9
Total	1543	412	308	508	2771	100.0
Percent	55.7	14.9	11.1	18.3	100.0	

U.S. General Aviation Accidents - 1985
Fire After Impact

C204 ---->

C27

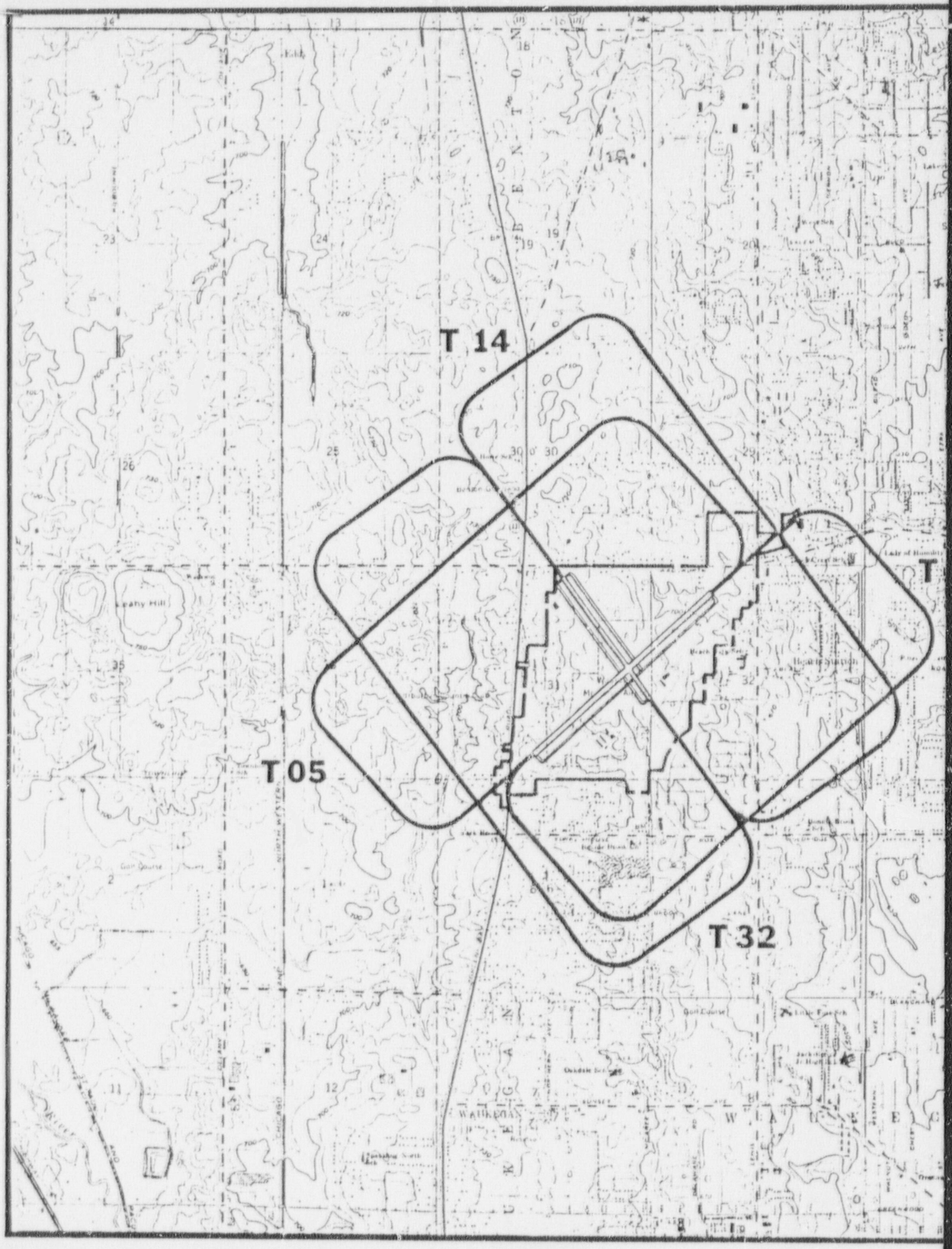
	None	Minor Ser		Fatal	Total	Pct
Off airport/airstrip	29	17	17	135	198	75.0
On airport	25	6	8	17	56	21.2
On airstrip	4	2	0	1	7	2.7
Other	0	0	1	2	3	1.1
Total	58	25	26	155	264	100.0
Percent	22.0	9.5	9.8	58.7	100.0	

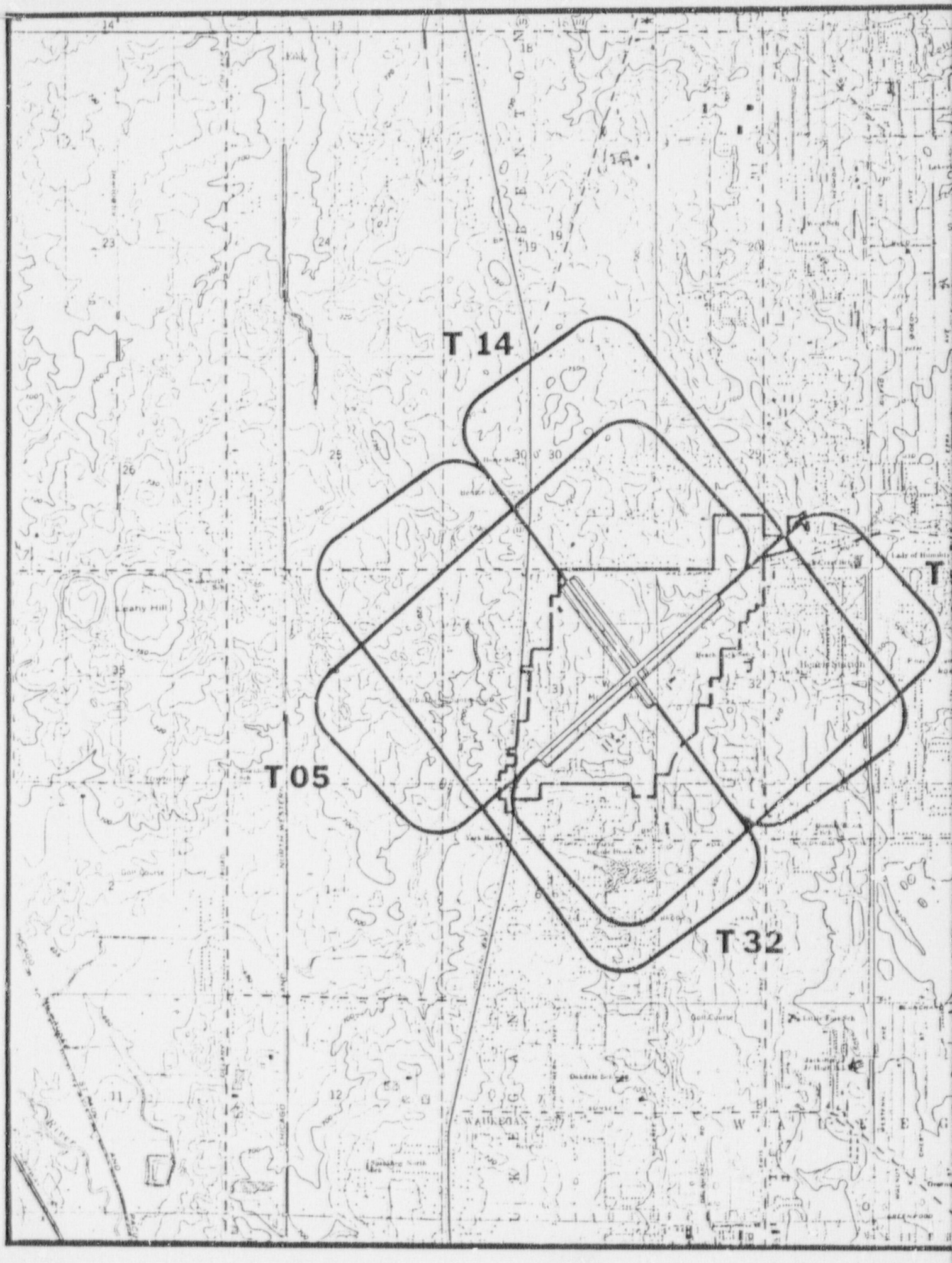
APPENDIX 4

1986 Flight Tracks - Touch & Go Operations

1986 Flight Tracks - Departures

1986 Flight Tracks - Arrivals


T 14
T
T 05
T 32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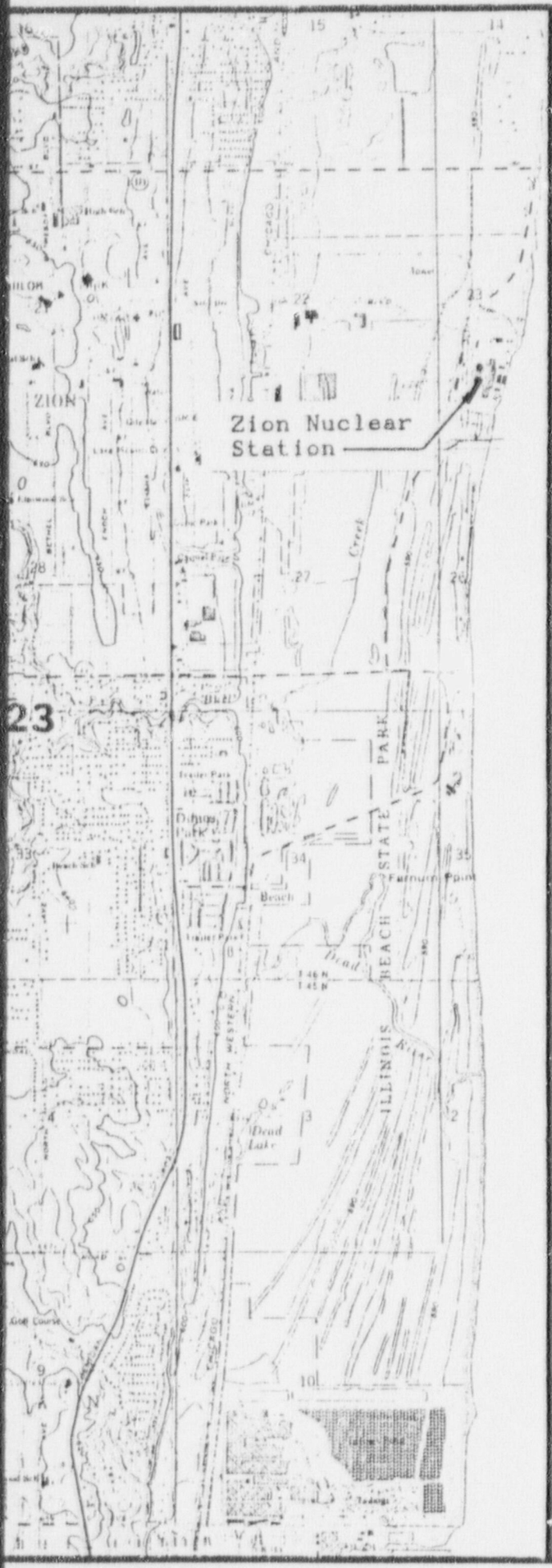
T
T 05
T 32



WAUKEGAN REGIONAL AIRPORT

FAR Part 150 Airport Noise Exposure Maps

LEGEND

Airport Property Line

T14 Flight Tracks

For Specific Aircraft Usage See Appendix I

Wm. J. Murray & Associates, Inc.

0' 3000' 6000'

SCALE IN FEET

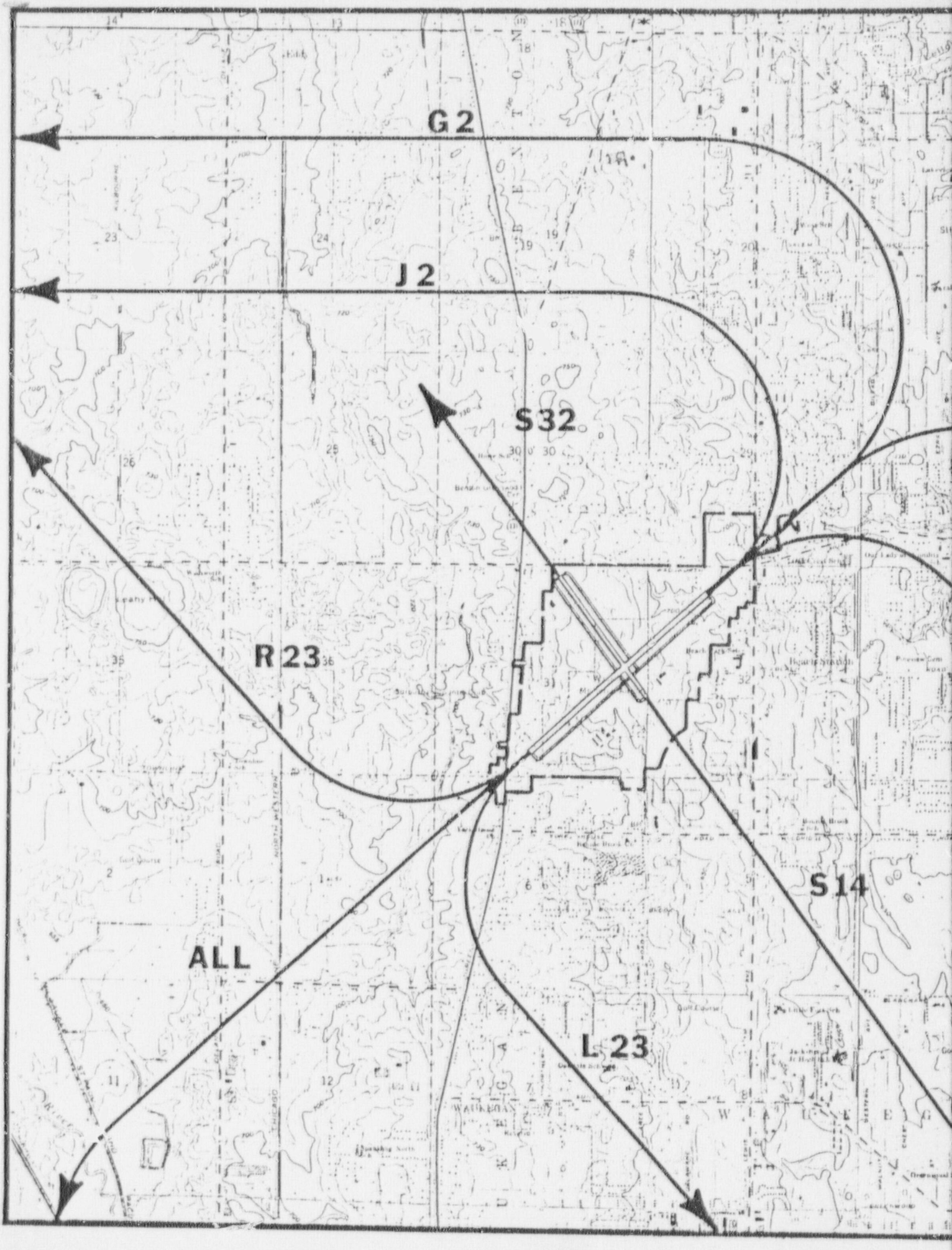
N

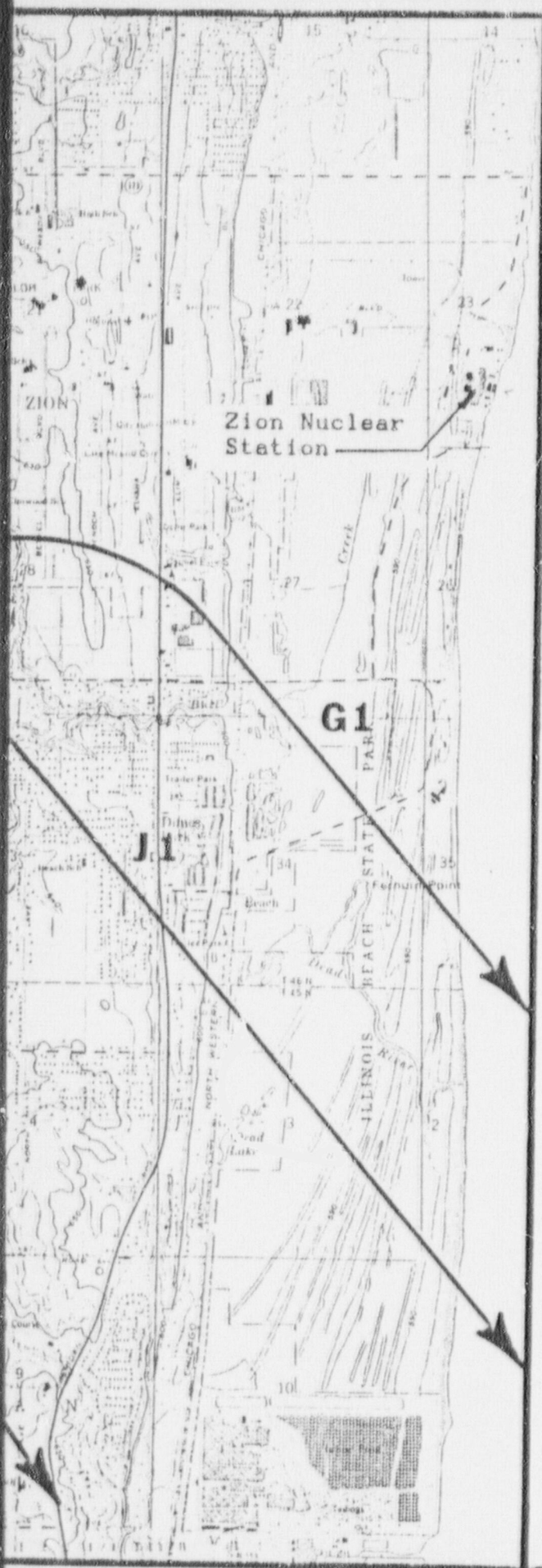
8907250039 - 01

FLIGHT TRACKS

TOUCH & GO

FIGURE 1


G2
J2
S32
R23
S14
ALL
L23



WAUKEGAN REGIONAL AIRPORT

FAR Part 150 Airport Noise Exposure Maps

LEGEND

Airport Property Line

G2 Flight Tracks

For Specific Aircraft Useage
See Appendix I

Wm. J. Murray & Associates, Inc.

0' 3000' 6000'

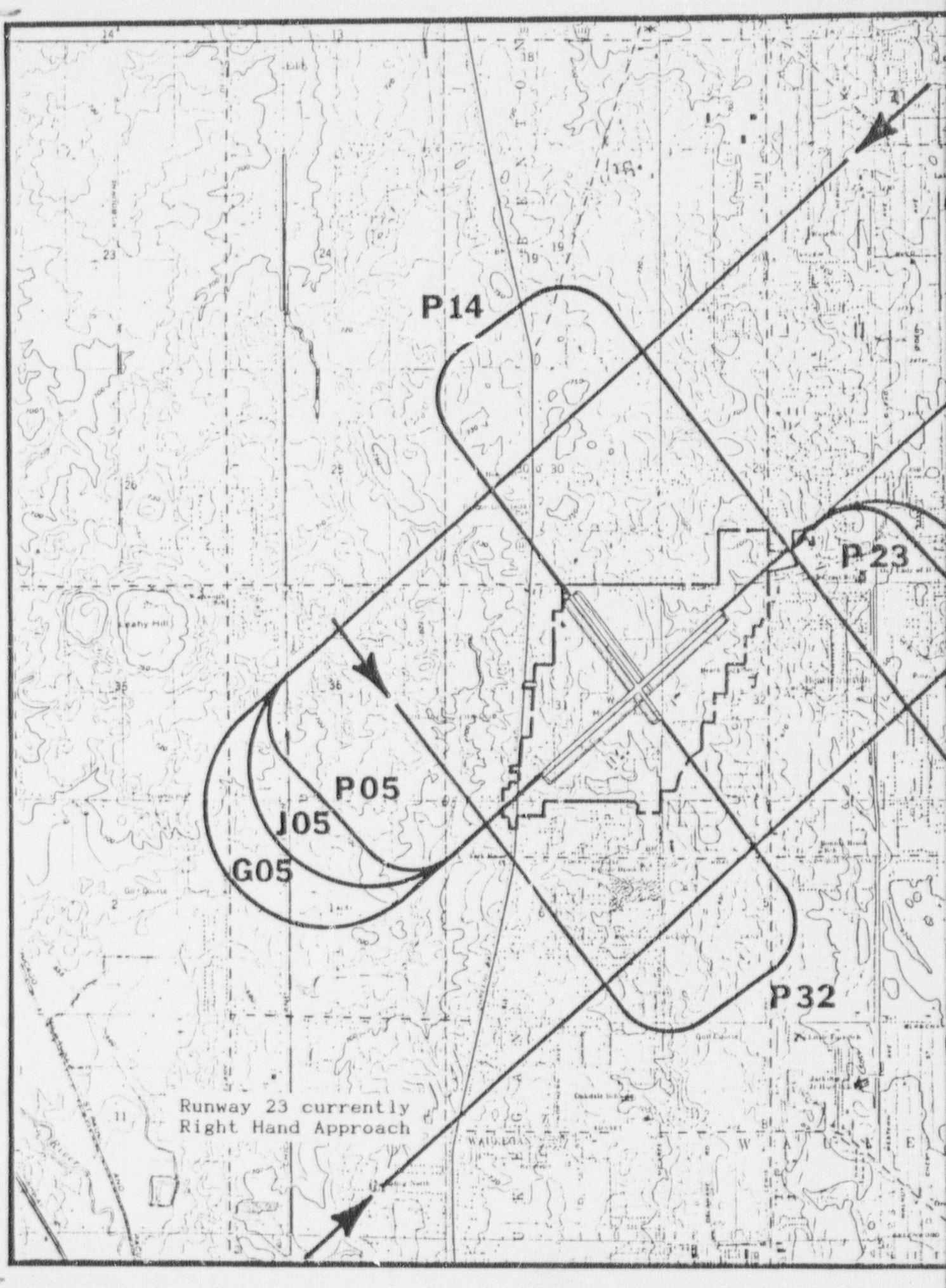
SCALE IN FEET

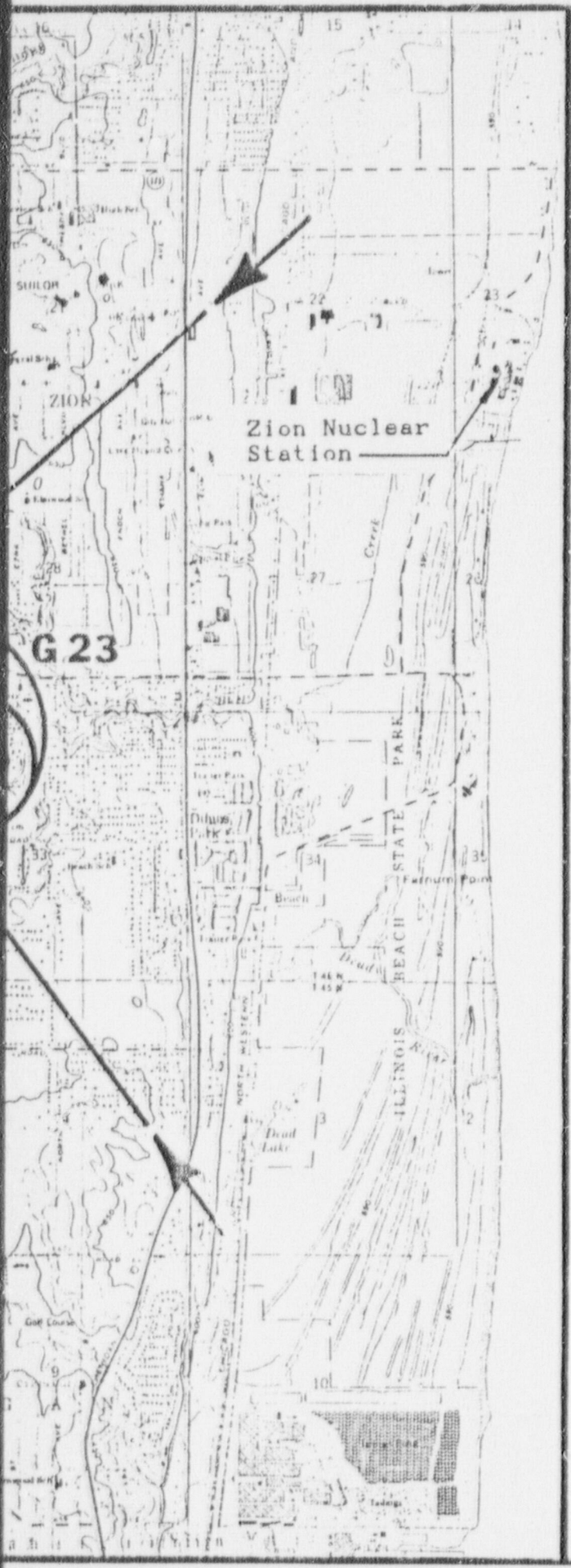
N

1986 FLIGHT TRACKS

DEPARTURES

FIGURE 2


P14
P23
P05
J05
G05
P32
Runway 23 currently
Right Hand Approach



WAUKEGAN REGIONAL AIRPORT

FAR Part 150 Airport Noise Exposure Maps

LEGEND

Airport Property Line

G23 Flight Tracks

For Specific Aircraft Usage See Appendix I

Wm. J. Murray & Associates, Inc.

0' 3000' 6000'

SCALE IN FEET

N

8907250039 903

1986 FLIGHT TRACKS

ARRIVALS

FIGURE 3

APPENDIX 5

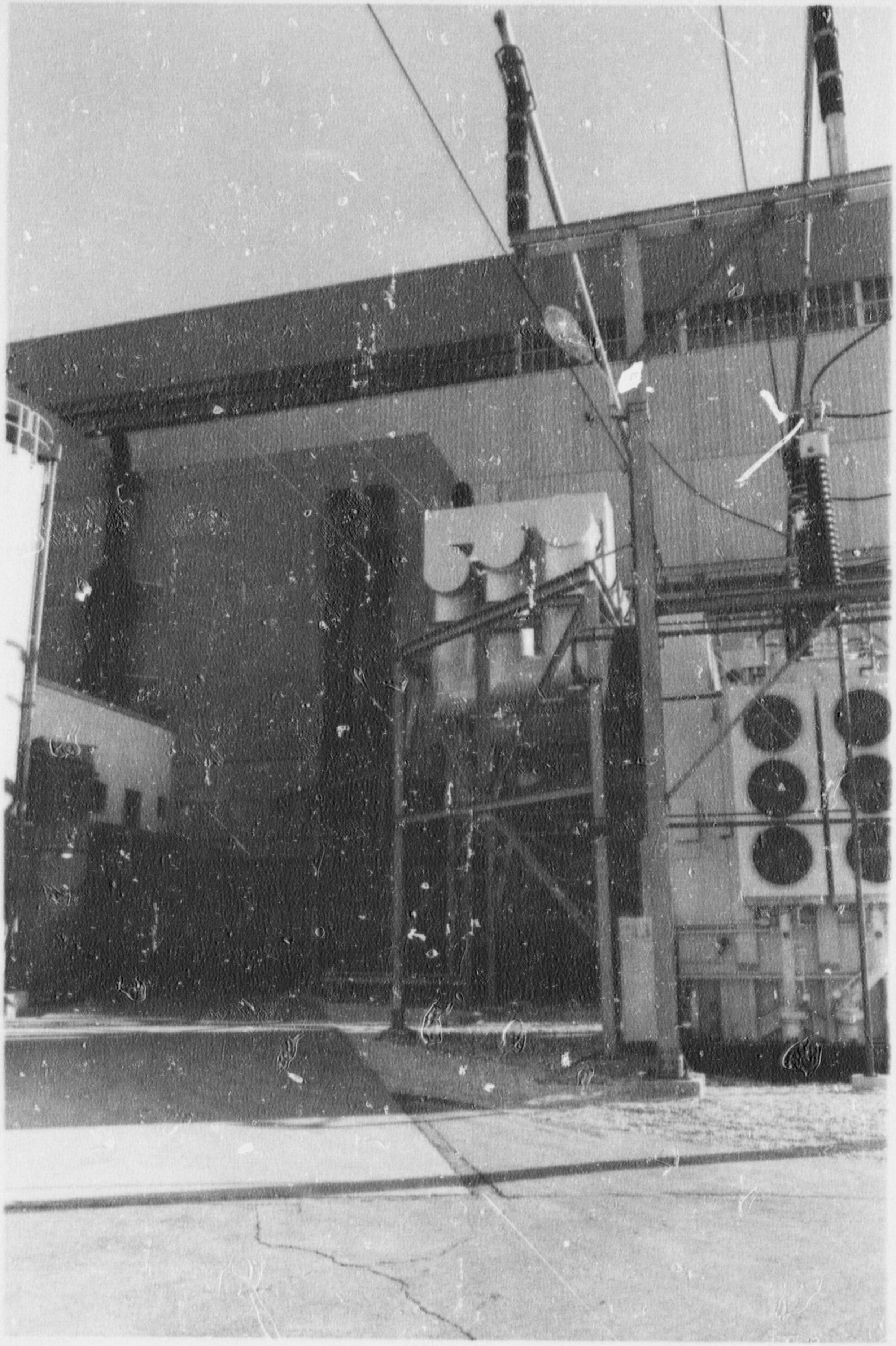
Photographs of Plant Target Areas

Photograph 1 - Aerial View of Zion Nuclear Plant

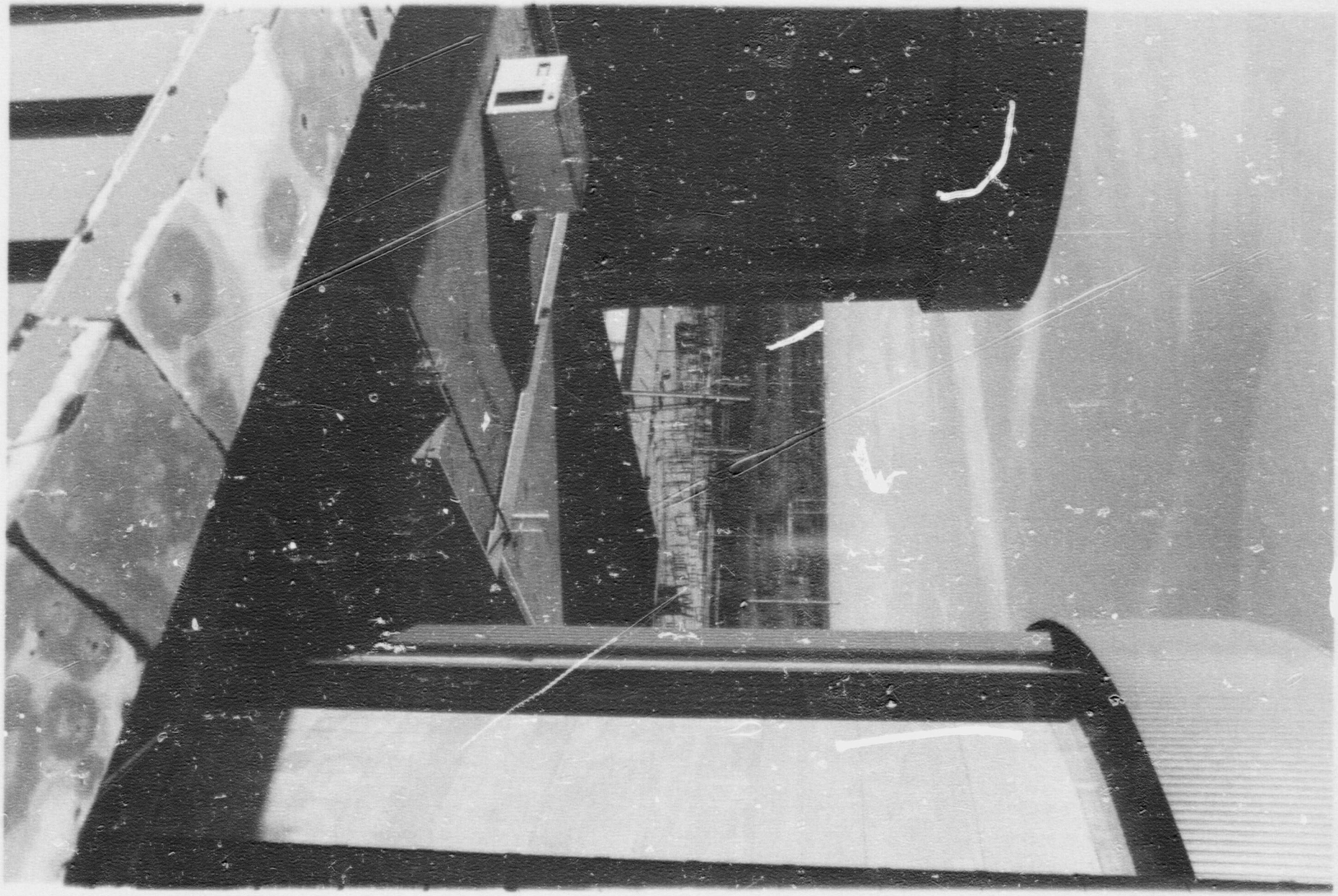
Photograph 2 - View of Area A - Diesel Generator and Switchgear Room Ventilation Intakes (Unit 1)

Photograph 3 - View of Area B - Auxiliary Building Ventilation Intakes

Photograph 4 - View of Area C - Crib House Service Water Ventilation Intakes



Photograph 2



Photograph 3

Photograph 4

APPENDIX 6

Complete Accident History of Waukegan Regional Airport

Years - 1964 through 1987

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D. C. 20594

BRIEFS OF OCCURRENCES INVOLVING

WAUKEGAN MEMORIAL AIRPORT, ILLINOIS

U.S. CIVIL AVIATION

1964 - 1981

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
[illegible]	04/20/77	WAUKEGAN ILL	LUSCOMBE 8F	CR- 0 0 1	NONCOMMERCIAL	STUDENT, AGE 28, 108
	TIME - 1515	N19818		PX- 0 0 0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 69 IN TYPE,
		DAMAGE-SUBSTANTIAL		OI- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

TYPE OF ACCIDENT
GROUND-WATER LOOP-SWERVE
NOSE OVER/DOWN

PHASE OF OPERATION
LANDING: ROLL
LANDING: ROLL

PROBABLE CAUSE(S)
PILOT IN COMMAND - IMPROPER COMPENSATION FOR WIND CONDITIONS
WEATHER - UNFAVORABLE WIND CONDITIONS

SKY CONDITION
CLEAR

CEILING AT ACCIDENT SITE
UNLIMITED

VISIBILITY AT ACCIDENT SITE
5 OR OVER(UNLIMITED)

PRECIPITATION AT ACCIDENT SITE
NONE

OBSTRUCTIONS TO VISION AT ACCIDENT SITE
NONE

RELATIVE BEARING OF WIND
RIGHT QUARTERING HEAD WIND 023-067 DEGREES

TYPE OF WEATHER CONDITIONS
VFR

TYPE OF FLIGHT PLAN
NONE

REMARKS- GUSTY CROSSWIND.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-0521	05/27/71 TIME - 1435	WAUKEGAN ILL	BEECHCRAFT 23 N2330L DAMAGE-SUBSTANTIAL	CR- 0 0 2 PX- 0 0 0 OT- 0 0 0	INSTRUCTIONAL DUAL	COMMERCIAL, FL.INSTR., AGE 36, 553 TOTAL HOURS, 4 IN TYPE, NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL
TYPE OF ACCIDENT
HARD LANDING
GEAR COLLAPSED

PHASE OF OPERATION
LANDING: LEVEL OFF/TOUCHDOWN
TAKEOFF: RUN

PROBABLE CAUSE(S)
DUAL STUDENT - IMPROPER LEVEL OFF
AIRFRAME - LANDING GEAR: MAIN GEAR-SHOCK ABSORBING ASSY,STRUTS,ATTACHMENTS,ETC.
MISCELLANEOUS ACTS,CONDITIONS - OVERLOAD FAILURE
MISCELLANEOUS ACTS,CONDITIONS - SEPARATION IN FLIGHT
FACTOR(S)
WEATHER - UNFAVORABLE WIND CONDITIONS

SKY CONDITION
CLEAR
VISIBILITY AT ACCIDENT SITE
3 OR OVER(UNLIMITED)
OBSTRUCTIONS TO VISION AT ACCIDENT SITE
NONE
TEMPERATURE-F
[illegible]
WIND VELOCITY-KNOTS
25
TYPE OF FLIGHT PLAN
NONE

CEILING AT ACCIDENT SITE
UNLIMITED
PRECIPITATION AT ACCIDENT SITE
NONE
RELATIVE BEARING OF WIND
LEFT CROSS WIND 248-292 DEGREES
WIND DIRECTION-DEGREES
270
TYPE OF WEATHER CONDITIONS
VFR

REMARKS- RIGHT MAIN GEAR SEPARATED AFTER LIFTOFF. GUSTY CROSSWIND TO 35 KNOTS.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-3523	05/??/??	WAUKEGAN ILL	PIPER PA-22	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 30, 155
	TIME - 1?45		N5481Z	PR- 0 0 1	BUSINESS	TOTAL HOURS, 120 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

TYPE OF ACCIDENT
COLLIDED WITH: SNOWBANK

PHASE OF OPERATION
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
MISCELLANEOUS ACTS,CONDITIONS - NOT ALIGNED WITH RUNWAY/INTENDED LANDING AREA
FACTOR(S)
WEATHER - SNOW

SKY CONDITION
OVERCAST

CEILING AT ACCIDENT SITE
1500

VISIBILITY AT ACCIDENT SITE
3 MILES OR LESS

PRECIPITATION AT ACCIDENT SITE
SNOW SHOWERS

OBSTRUCTIONS TO VISION AT ACCIDENT SITE
BLOWING SNOW

TEMPERATURE-F
30

WIND DIRECTION-DEGREES
315

WIND VELOCITY-KNOTS
3

TYPE OF WEATHER CONDITIONS
VFR

TYPE OF FLIGHT PLAN
NONE

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
2-0034	66/271	WAUKEGAN ILL	BEECH 95D	CR- 0 1 0	NONCOMMERCIAL	PRIVATE, AGE 35, 90S
	TIME - 2037		N3660B	PX- 0 0 0	BUSINESS	TOTAL HOURS, 170 IN TYPE,
			DAMAGE-DESTROYED	OT- 0 0 0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

TYPE OF ACCIDENT
- ENGINE FAILURE OR MALFUNCTION
- STALL: SPIN

PHASE OF OPERATION
- LANDING: FINAL APPROACH
- LANDING: FINAL APPROACH

PROBABLE CAUSE(S)
- POWERPLANT - MISCELLANEOUS: POWERPLANT FAILURE FOR UNDETERMINED REASONS
- PILOT IN COMMAND - FAILED TO OBTAIN/MAINTAIN FLYING SPEED

FACTOR(S)
- MISCELLANEOUS ACTS,CONDITIONS - AIRFRAME ICE
- MISCELLANEOUS ACTS,CONDITIONS - ICE-WINDSHIELD
- WEATHER - ICING CONDITIONS-INCLUDES SLEET,FREEZING RAIN,ETC.

PARTIAL POWER LOSS - UNKNOWN/NOT REPORTED

COMPLETE POWER LOSS - UNKNOWN/NOT REPORTED

WEATHER BRIEFING - BRIEFING RECEIVED-METHOD UNKNOWN

WEATHER FORECAST - FORECAST SUBSTANTIALLY CORRECT

SKY CONDITION
- CLEAR

CEILING AT ACCIDENT SITE
- UNLIMITED

VISIBILITY AT ACCIDENT SITE
- 5 OR OVER(UNLIMITED)

PRECIPITATION AT ACCIDENT SITE
- NONE

OBSTRUCTIONS TO VISION AT ACCIDENT SITE
- NONE

TEMPERATURE-F
- 25

WIND DIRECTION-DEGREES
- 50

WIND VELOCITY-KNOTS
- 10

TYPE OF WEATHER CONDITIONS
- VFR

TYPE OF FLIGHT PLAN
- NONE

REMARKS- PLT CANCELLED IFR FLT PLAN PRIOR TO LDG.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES				FLIGHT PURPOSE	PILOT DATA
				F	S	M/N			
[illegible]	[illegible]	WAUKEGAN ILL	ALON A-2	CR-	0	0	2	INSTRUCTIONAL	COMMERCIAL, FL.INSTR.,
	TIME - 1030		N6357V	PX-	0	0	0	DUAL	AGE 49, 970 TOTAL HOURS,
			DAMAGE-SUBSTANTIAL	OT-	0	0	0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN

TYPE OF ACCIDENT
STALL: MUSH

PHASE OF OPERATION
TAKEOFF: INITIAL CLIMB

PROBABLE CAUSE(S)
PILOT IN COMMAND - FAILED TO OBTAIN/MAINTAIN FLYING SPEED

FACTOR(S)
MISCELLANEOUS ACTS,CONDITIONS - SIMULATED CONDITIONS

REMARKS- SIMULATED FORCED LANDING

[illegible]	[illegible]	WAUKEGAN ILL	TEMCO D-16	CR-	0	0	1	NONCOMMERCIAL	COMMERCIAL, AGE 41, 3500
	TIME - 1930		N712T	PX-	0	0	0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 70 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT-	0	0	0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

TYPE OF ACCIDENT
WHEELS-UP

PHASE OF OPERATION
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
PILOT IN COMMAND - FAILED TO EXTEND LANDING GEAR

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-3517	08/10/71	WAUKEGAN ILL	BEECH D50A	CR- 0 0 1	NONCOMMERCIAL	COMMERCIAL, FL.INSTR.,
	TIME - 1200		M660M	PX- 0 0 0	CORP/EXEC	AGE 52, 14000 TOTAL
			DAMAGE-SUBSTANTIAL	GI- 0 0 0		HOURS, 439 IN TYPE,
						INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

TYPE OF ACCIDENT
WHEELS-UP

PHASE OF OPERATION
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
PILOT IN COMMAND - FAILED TO EXTEND LANDING GEAR
REMARKS- WIND GUSTING 30 TO 45 KNOTS.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES				FLIGHT PURPOSE	PILOT DATA
					F	S	M/N		
3-3665	66/11/23	WAUKEGAN ILL	CESSNA 172	CR-	0	0	1	NONCOMMERCIAL	PRIVATE, AGE 36, 370
	TIME - 1400		N6663A	PX-	0	0	0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 10 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT-	0	0	0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

TYPE OF ACCIDENT
GROUND-WATER LOOP-SWERVE
NOSE OVER/DOWN

PHASE OF OPERATION
TAXI: TO TAKEOFF
TAXI: TO TAKEOFF

PROBABLE CAUSE(S)
PILOT IN COMMAND - EXERCISED POOR JUDGMENT
PILOT IN COMMAND - TAXIED/PARKED WITHOUT PROPER ASSISTANCE
WEATHER - UNFAVORABLE WIND CONDITIONS

WEATHER BRIEFING - NO RECORD OF BRIEFING RECEIVED

SKY CONDITION
UNKNOWN/NOT REPORTED

CEILING AT ACCIDENT SITE
3300

VISIBILITY AT ACCIDENT SITE
5 OR OVER(UNLIMITED)

PRECIPITATION AT ACCIDENT SITE
NONE

OBSTRUCTIONS TO VISION AT ACCIDENT SITE
NONE

RELATIVE BEARING OF WIND
LEFT CROSS WIND 248-292 DEGREES

TEMPERATURE-F
74

WIND DIRECTION-DEGREES
330

WIND VELOCITY-KNOTS
10

TYPE OF WEATHER CONDITIONS
VFR

TYPE OF FLIGHT PLAN
NONE

REMARKS- 70 DEG.LEFT CROSSWIND 19KTS.GUSTING TO 30 KTS.PLT WAS AWARE WIND WAS AVERAGING 20-25 KTS.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-[illegible]	[illegible]	WAUKEGAN,ILL	CESSNA 310C	CR- 0 0 2	INSTRUCTIONAL	AIP,FLIGHT INSTR.,AGE 29, 3007 TOTAL HOURS, 155 IN TYPE, NOT INSTRUMENT RATED.
	TIME - 1[illegible]		N4[illegible]EA	PX- 0 0 0	DUAL	
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		

NAME OF AIRPORT - WAUKEGAN
TYPE OF ACCIDENT
ENGINE FAILURE OR MALFUNCTION
GROUND-WATER LOOP-SWERVE

PHASE OF OPERATION
LANDING: FINAL APPROACH
LANDING: ROLL

PROBABLE CAUSE(S)
MISCELLANEOUS ACTS,CONDITIONS - SIMULATED CONDITIONS
DUAL STUDENT - FAILED TO MAINTAIN DIRECTIONAL CONTROL
PILOT IN COMMAND - INADEQUATE SUPERVISION OF FLIGHT
REMARKS- SIMULATED SINGLE-ENGINE OPERATION.

3-4567	67/12/31	WAUKEGAN,ILL	PIPER PA-28	CR- 0 0 1	NONCOMMERCIAL	STUDENT, AGE 26, 63 TOTAL HOURS, 47 IN TYPE, NOT INSTRUMENT RATED.
	TIME - 1230		N6195W	PX- 0 0 1	PLEASURE/PERSONAL TRANSP	
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		

NAME OF AIRPORT - WAUKEGAN MEMORIAL
TYPE OF ACCIDENT
GEAR COLLAPSED

PHASE OF OPERATION
LANDING: ROLL

PROBABLE CAUSE(S)
MISCELLANEOUS - UNDETERMINED
REMARKS- NOSE WHEEL FAILED FOR UNKNOWN REASON.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-1229	68/[illegible]/12	WAUKEGAN,ILL	CESSNA 172H	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 55, 438
	TIME - 1200		N[illegible]23L	PX- 0 0 0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, ALL IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

TYPE OF ACCIDENT
- ENGINE FAILURE OR MALFUNCTION
- COLLIDED WITH: TREES

PHASE OF OPERATION
- IN FLIGHT: DESCENDING
- LANDING: OTHER

PROBABLE CAUSE(S)
- PILOT IN COMMAND - IMPROPER OPERATION OF POWERPLANT & POWERPLANT CONTROLS
- MISCELLANEOUS ACTS,CONDITIONS - ANTI-ICING/DEICING EQUIPMENT-IMPROPER OPERATION OF/OR FAILED TO USE
- MISCELLANEOUS ACTS,CONDITIONS - ICE-CARBURETOR

COMPLETE POWER LOSS - COMPLETE ENGINE FAILURE/FLAMEOUT-1 ENGINE

EMERGENCY CIRCUMSTANCES - FORCED LANDING OFF AIRPORT ON LAND

REMARKS- ALSO STRUCK A HOUSE.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-3944	69/10/26	WAUKEGAN,ILL	PIPER PA-28	CR- 0 1 0	NONCOMMERCIAL	STUDENT, AGE 21, 34 TOTAL
	TIME - 0200		N6898W	PX- 0 0 2	PLEASURE/PERSONAL TRANSP	HOURS, 11 IN TYPE, NOT
			DAMAGE-DESTROYED	OT- 0 0 0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN

TYPE OF ACCIDENT
- UNDERSHOOT
- COLLIDED WITH: TREES

PHASE OF OPERATION
- LANDING: FINAL APPROACH
- LANDING: FINAL APPROACH

PROBABLE CAUSE(S)
- PILOT IN COMMAND - MISJUDGED DISTANCE AND ALTITUDE

FACTOR(S)
- MISCELLANEOUS ACTS,CONDITIONS - STOLEN OR UNAUTHORIZED USE OF AIRCRAFT

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-03[illegible]	5[illegible]/75	WAUKEGAN, ILL	BEECH A23-19	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 44, 250
	TIME - 1100		N4771J	PX- 0 0 2	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 8 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN
TYPE OF ACCIDENT
COLLIDED WITH: SNOWBANK
GEAR COLLAPSED

PHASE OF OPERATION
LANDING: ROLL
LANDING: ROLL

PROBABLE CAUSE(S)
PILOT IN COMMAND - IMPROPER COMPENSATION FOR WIND CONDITIONS
FACTOR(S)
MISCELLANEOUS ACTS,CONDITIONS - OVERLOAD FAILURE
REMARKS- WIND 1PK GUSTING 25K. GR DAMAGED LDG AT JANESVILLE,COLLAPSED LDG AT WAUKEGAN.

3-0385	6[illegible]/75	WAUKEGAN, ILL	BEECH C35	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 33, 350
	TIME - 1130		N[illegible]52D	PX- 0 1 0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 50 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN
TYPE OF ACCIDENT
WHEELS-UP

PHASE OF OPERATION
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
PILOT IN COMMAND - FAILED TO EXTEND LANDING GEAR
FACTOR(S)
MISCELLANEOUS ACTS,CONDITIONS - CHECKLIST-FAILED TO USE
AIRFRAME - LANDING GEAR: LANDING GEAR WARNING AND INDICATING COMPONENTS
MISCELLANEOUS ACTS,CONDITIONS - CORRODED/CORROSION
REMARKS- GEAR WARNING HORN INOPERATIVE.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-1540	70/4/7	WAUKEGAN,ILL	BEECH A23-19	CR- 0 0 2	INSTRUCTIONAL	COMMERCIAL, FL.INSTR.,
	TIME - 1650		N6080N	PX- 0 0 0	DUAL	AGE 27, 382 TOTAL HOURS,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		120 IN TYPE, NOT
						INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN
DEPARTURE POINT
WAUKEGAN,ILL
INTENDED DESTINATION
LOCAL
TYPE OF ACCIDENT
STALL: MUSH
PHASE OF OPERATION
LANDING: GO-AROUND

PROBABLE CAUSE(S)
DUAL STUDENT - IMPROPER COMPENSATION FOR WIND CONDITIONS
PILOT IN COMMAND - INADEQUATE SUPERVISION OF FLIGHT
PILOT IN COMMAND - FAILED TO OBTAIN/MAINTAIN FLYING SPEED
REMARKS- WIND GUSTING 19K.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-3332	70/8/12	WAUKEGAN,ILL	BELLANCA 17-30	CR- 0 0 2	INSTRUCTIONAL	COMMERCIAL, AGE 39, 3887
	TIME - 1830		N4956V	PX- 0 0 0	DUAL	TOTAL HOURS, 8 IN TYPE,
			DAMAGE-DESTROYED	OT- 0 0 0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN
DEPARTURE POINT
NORTHBROOK,ILL
INTENDED DESTINATION
WAUKEGAN,ILL
TYPE OF ACCIDENT
WHEELS-UP
PHASE OF OPERATION
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
DUAL STUDENT - FAILED TO EXTEND LANDING GEAR
PILOT IN COMMAND - INADEQUATE SUPERVISION OF FLIGHT
FACTOR(S)
MISCELLANEOUS ACTS,CONDITIONS - TOUCH AND GO LANDING
FIRE AFTER IMPACT
REMARKS- ACFT OBSVD ON FINAL APCH WHEELS UP.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-2304	71/6/3	WAUKEGAN,ILL	CESSNA 310C	CR- 0 0 1	NONCOMMERCIAL	COMMERCIAL, AGE 29, 1323
	TIME - 1735		N585KM	PX- 0 0 2	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 30 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL
DEPARTURE POINT — INTENDED DESTINATION
WAUKEGAN,ILL — LOCAL
TYPE OF ACCIDENT — PHASE OF OPERATION
GEAR COLLAPSED — LANDING: ROLL

PROBABLE CAUSE(S)
AIRFRAME - LANDING GEAR: MAIN GEAR-SHOCK ABSORBING ASSY,STRUTS,ATTACHMENTS,ETC.
MISCELLANEOUS ACTS,CONDITIONS - MATERIAL FAILURE
PERSONNEL - MAINTENANCE,SERVICING,INSPECTION: INADEQUATE MAINTENANCE AND INSPECTION
REMARKS- WASHER WORN,BOLT PULLED THRU,TORQUE LINKS DSCNCTD,R GR COLLAPSED.

3-3709	71/9/13	WAUKEGAN,ILL	PIPER PA-24	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 23, 277
	TIME - 0700		N7232P	PX- 0 0 1	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 93 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN
DEPARTURE POINT — INTENDED DESTINATION
LENA,ILL — WAUKEGAN,ILL
TYPE OF ACCIDENT — PHASE OF OPERATION
COLLIDED WITH: DIRT BANK — TAXI: FROM LANDING

PROBABLE CAUSE(S)
PILOT IN COMMAND - MISJUDGED SPEED
REMARKS- TAXING TOO FAST TO MAKE TURN OFF RWY HIT MOUND OF DIRT AT END OF RWY.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-2974	72/3/16	WAUKEGAN,ILL	BEECH C50	CR- 0 1 0	NONCOMMERCIAL	PRIVATE, AGE 52, 2173
	TIME - 1709		N37528	PX- 0 0 0	BUSINESS	TOTAL HOURS, 47 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

DEPARTURE POINT
JOLIET,ILL

INTENDED DESTINATION
WAUKEGAN,ILL

TYPE OF ACCIDENT
STALL

PHASE OF OPERATION
LANDING: FINAL APPROACH

PROBABLE CAUSE(S)
PILOT IN COMMAND - FAILED TO OBTAIN/MAINTAIN FLYING SPEED
WEATHER - ICING CONDITIONS-INCLUDES SLEET,FREEZING RAIN,ETC.

WEATHER BRIEFING - BRIEFED BY FLIGHT SERVICE PERSONNEL, BY PHONE

WEATHER FORECAST - FORECAST SUBSTANTIALLY CORRECT

SKY CONDITION
UNKNOWN/NOT REPORTED

CEILING AT ACCIDENT SITE
1000

VISIBILITY AT ACCIDENT SITE
3 MILES OR LESS

PRECIPITATION AT ACCIDENT SITE
NONE

OBSTRUCTIONS TO VISION AT ACCIDENT SITE
FOG

WIND DIRECTION-DEGREES
320

WIND VELOCITY-KNOTS
10

TYPE OF WEATHER CONDITIONS
VFR

TYPE OF FLIGHT PLAN
IFR

REMARKS- TURNING FINAL A/S 100 MPH & OUT OF CONTROL.STALL SPEED-60DEG BANK,PWR OFF,GR & FLAPS DN-97MPH.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-1994	74/3/3	WAUKEGAN,ILL	CESSNA 172M	CR- 0 0 1	NONCOMMERCIAL	STUDENT, AGE 27, 81 TOTAL
	TIME - 2045		N4381R	PX- 0 0 0	PLEASURE/PERSONAL TRANSP	HOURS, 56 IN TYPE, NOT
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN
DEPARTURE POINT
WHEELING,ILL
INTENDED DESTINATION
WAUKEGAN,ILL
TYPE OF ACCIDENT
COLLIDED WITH: WIRES/POLES
PHASE OF OPERATION
IN FLIGHT: OTHER

PROBABLE CAUSE(S)
PILOT IN COMMAND - PHYSICAL IMPAIRMENT
PILOT IN COMMAND - BECAME LOST/DISORIENTED
PILOT IN COMMAND - MISJUDGED ALTITUDE AND CLEARANCE
FACTOR(S)
PILOT IN COMMAND - ATTEMPTED OPERATION W/KNOWN DEFICIENCIES IN EQUIPMENT
POWERPLANT - IGNITION SYSTEM: SPARK PLUG
MISCELLANEOUS ACTS,CONDITIONS - UNWARRANTED LOW FLYING
TERRAIN - HIGH OBSTRUCTIONS
REMARKS- LOST,ASSISTED BY OTR ACFT.DSCNDD BLO OBSTRUCTING TRRN.FLEW INTO WIRES.TOOK 2 VALIUM PILLS EARLIER.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
5-5031	74/ 7/17	WAUKEGAN,ILL	ALON A-2	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 26, 106
	TIME - 1415		N5654F	PX- 0 0 1	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 35 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.
	NAME OF AIRPORT - WAUKEGAN MEMORIAL					
	DEPARTURE POINT	INTENDED DESTINATION				
	CHICAGO,ILL	LOCAL				
	TYPE OF ACCIDENT		PHASE OF OPERATION			
	COLLIDED WITH: AIRPORT HAZARD		LANDING: ROLL			
	PROBABLE CAUSE(S)					
	PILOT IN COMMAND - SELECTED UNSUITABLE TERRAIN					
	FACTOR(S)					
	PILOT IN COMMAND - INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING					
	AIRPORTS/AIRWAYS/FACILITIES - AIRPORT CONDITIONS: OTHER					
	MISCELLANEOUS ACTS,CONDITIONS - RUNWAY CLOSED					
	MISCELLANEOUS ACTS,CONDITIONS - LANDED IN CONSTRUCTION AREA					
	REMARKS- RWYS CLOSED,ADJ TWY USED FOR LDG,THRESHOLD DISPLACED BY OTR RWY,NOTAMED,MARKED,LNDD SHORT.					
5-5[illegible]	74/[illegible]/25	WAUKEGAN,ILL	BEECH B19	CR- 0 0 1	INSTRUCTIONAL	STUDENT, AGE 32, 66 TOTAL
	TIME - 1205		N24685	PX- 0 0 0	SOLO	HOURS, ALL IN TYPE, NOT
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		INSTRUMENT RATED.
	NAME OF AIRPORT - WAUKEGAN MEMORIAL					
	DEPARTURE POINT	INTENDED DESTINATION				
	WAUKEGAN,ILL	LOCAL				
	TYPE OF ACCIDENT		PHASE OF OPERATION			
	GROUND-WATER LOOP-SWERVE		LANDING: ROLL			
	COLLIDED WITH: DIRT BANK		LANDING: ROLL			
	PROBABLE CAUSE(S)					
	PILOT IN COMMAND - FAILED TO MAINTAIN DIRECTIONAL CONTROL					
	FACTOR(S)					
	AIRPORTS/AIRWAYS/FACILITIES - AIRPORT CONDITIONS: OTHER					
	REMARKS- STRUCK MOUND OF DIRT ADJ TO RWY.					

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-4099	78/07/11	WAUKEGAN, IL	BRANTLY B2B	CR- 0 0 2	INSTRUCTIONAL	COMMERCIAL, FL.INSTR.,
	TIME - 0900		N44DS	OR- 0 0 0	DUAL	AGE 44, 1597 TOTAL HOURS,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		127 IN TYPE, NOT
						INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

DEPARTURE POINT
WAUKEGAN, IL

INTENDED DESTINATION
LOCAL

TYPE OF ACCIDENT
HARD LANDING

PHASE OF OPERATION
LANDING: POWER-ON LANDING

PROBABLE CAUSE(S)
PILOT IN COMMAND - INADEQUATE SUPERVISION OF FLIGHT
DUAL STUDENT - IMPROPER OPERATION OF FLIGHT CONTROLS

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
[illegible]	[illegible]/11	[illegible]	CESSNA 140	EN- 0 0 1	NONCOMMERCIAL	COMMERCIAL, FL,INSTR,,
	TIME - 0640		N7018F	PX- 0 0 1	PLEASURE/PERSONAL TRANSP	AGE 50, 1255 TOTAL HOURS,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		983 IN TYPE, NOT
						INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL

DEPARTURE POINT
WAUKEGAN,IL

INTENDED DESTINATION
MATTOON,IL

TYPE OF ACCIDENT
ENGINE FAILURE OR MALFUNCTION
HARD LANDING

PHASE OF OPERATION
TAKEOFF: INITIAL CLIMB
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
PILOT IN COMMAND - IMPROPER OPERATION OF POWERPLANT & POWERPLANT CONTROLS
MISCELLANEOUS ACTS,CONDITION - ANTI-ICING/DEICING EQUIPMENT-IMPROPER OPERATION OF/OR FAILED TO USE
MISCELLANEOUS ACTS,CONDITION - ICE-CARBURETOR
FACTOR(S)
WEATHER - CONDITIONS CONDUCIVE TO CARB./INDUCTION SYSTEM ICING
POWERPLANT - IGNITION SYSTEM: MAGNETOS
MISCELLANEOUS ACTS,CONDITIONS - FLUCTUATING
TERRAIN - ROUGH/UNEVEN
COMPLETE POWER LOSS - COMPLETE ENGINE FAILURE/FLAMEOUT-1 ENGINE
WEATHER BRIEFING - UNKNOWN/NOT REPORTED
EMERGENCY CIRCUMSTANCES - FORCED LANDING OFF AIRPORT ON LAND

SKY CONDITION
UNKNOWN/NOT REPORTED

CEILING AT ACCIDENT SITE
5000

VISIBILITY AT ACCIDENT SITE
4 MILES OR LESS

PRECIPITATION AT ACCIDENT SITE
NONE

OBSTRUCTIONS TO VISION AT ACCIDENT SITE
FOG

TEMPERATURE-F
45

WIND DIRECTION-DEGREES
200

WIND VELOCITY-KNOTS
5

TYPE OF WEATHER CONDITIONS
VFR

TYPE OF FLIGHT PLAN
NONE

REMARKS- PT MAG,EISEMAN MODEL LA-4 P/N H27705 S/N 46-24732,DID NOT FIRE #1,3,&4 TOP SPARK PLUGS.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-4475	7?/12/16	NR.WAUKEGAN,IL	HAWKER TMK20	CR- 1 0 0	NONCOMMERCIAL	COMMERCIAL, AGE 51, 4757
	TIME - 1100		N20SF	PX- 0 0 0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 1 IN TYPE,
			DAMAGE-DESTROYED	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL
DEPARTURE POINT
WAUKEGAN,IL
INTENDED DESTINATION
LOCAL
TYPE OF ACCIDENT
STALL: MUSH
PHASE OF OPERATION
TAKEOFF: INITIAL CLIMB

PROBABLE CAUSE(S)
PILOT IN COMMAND - PREMATURE LIFT-OFF
PILOT IN COMMAND - IMPROPER OPERATION OF FLIGHT CONTROLS
FACTOR(S)
PILOT IN COMMAND - LACK OF FAMILIARITY WITH AIRCRAFT
PERSONNEL - AIRPORT SUPERVISORY PERSONNEL: OTHER
FIRE AFTER IMPACT
REMARKS- PILOT LIVED THRU CRASH,DIED POST CRASH FIRE,10 MIN RESPONSE.FOREIGN ENG,OPPOSITE TORQUE.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
[illegible]-0153	2/1/19	WAUKEGAN,IL	CESSNA 310	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 54, 2187
	TIME - 1430		N1745G	PX- 0 0 0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 217 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN

DEPARTURE POINT
LAFAYETTE,IN

INTENDED DESTINATION
WAUKEGAN,IL

TYPE OF ACCIDENT
HARD LANDING
COLLIDED WITH: SNOWBANK

PHASE OF OPERATION
LANDING: LEVEL OFF/TOUCHDOWN
LANDING: ROLL

PROBABLE CAUSE(S)
PILOT IN COMMAND - IMPROPER LEVEL OFF

FACTOR(S)
MISCELLANEOUS ACTS,CONDITIONS - TCF-WINDSHIELD
WEATHER - ICING CONDITIONS-INCLUDES SLEET,FREEZING RAIN,ETC.
AIRPORTS/AIRWAYS/FACILITIES - AIRPORT CONDITIONS: SNOW ON RUNWAY

SKY CONDITION
UNKNOWN/NOT REPORTED

CEILING AT ACCIDENT SITE
600

VISIBILITY AT ACCIDENT SITE
2 MILES OR LESS

PRECIPITATION AT ACCIDENT SITE
NONE

OBSTRUCTIONS TO VISION AT ACCIDENT SITE
FOG

TYPE OF WEATHER CONDITIONS
IFR

TYPE OF FLIGHT PLAN
IFR

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-1964	08/5/27	WAUKEGAN, IL	MOONEY M20E	CR- 0 0 1	NONCOMMERCIAL	PRIVATE, AGE 31, 365
	TIME - 1830		N3247F	PX- 0 0 0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 29 IN TYPE,
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		NOT INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL
DEPARTURE POINT — INTENDED DESTINATION
WAUKEGAN, IL — LOCAL
TYPE OF ACCIDENT
ENGINE FAILURE OR MALFUNCTION
COLLISION WITH GROUND/WATER: CONTROLLED
PHASE OF OPERATION
LANDING: TRAFFIC PATTERN-CIRCLING
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
PILOT IN COMMAND - INADEQUATE PREFLIGHT PREPARATION AND/OR PLANNING
PILOT IN COMMAND - MISMANAGEMENT OF FUEL
MISCELLANEOUS ACTS,CONDITIONS - FUEL EXHAUSTION
COMPLETE POWER LOSS - COMPLETE ENGINE FAILURE/FLAMEOUT-1 ENGINE
EMERGENCY CIRCUMSTANCES - FORCED LANDING OFF AIRPORT ON LAND

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-0119	10/1/75	WINTHROP HBR,IL	CESSNA 310Q	CR- 1 0 0	NONCOMMERCIAL	PRIVATE, AGE 49, 757
	TIME - 1345		N40AK	PX- 1 0 0	PLEASURE/PERSONAL TRANSP	TOTAL HOURS, 221 IN TYPE,
			DAMAGE-DESTROYED	OT- 0 0 0		INSTRUMENT RATED.

NAME OF AIRPORT - WAUKEGAN MEMORIAL
DEPARTURE POINT
ADDISON,TX.
INTENDED DESTINATION
WINTHROP HBR,IL
TYPE OF ACCIDENT
COLLISION WITH GROUND/WATER: UNCONTROLLED
PHASE OF OPERATION
LANDING: INITIAL APPROACH

PROBABLE CAUSE(S)
PILOT IN COMMAND - SPATIAL DISORIENTATION
FACTOR(S)
WEATHER - LOW CEILING
WEATHER - RAIN
WEATHER - FOG
WEATHER BRIEFING - BRIEFED BY FLIGHT SERVICE PERSONNEL, BY PHONE
WEATHER FORECAST - FORECAST SUBSTANTIALLY CORRECT

SKY CONDITION
OVERCAST
CEILING AT ACCIDENT SITE
600
VISIBILITY AT ACCIDENT SITE
1 MILE OR LESS
PRECIPITATION AT ACCIDENT SITE
RAIN
OBSTRUCTIONS TO VISION AT ACCIDENT SITE
FOG
TEMPERATURE-F
49
WIND DIRECTION-DEGREES
160
WIND VELOCITY-KNOTS
10
TYPE OF WEATHER CONDITIONS
IFR
TYPE OF FLIGHT PLAN
IFR
FIRE AFTER IMPACT

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-2757	[illegible]	WAUKEGAN, IL	PIPER PA-23	CR- 0 0 2	INSTRUCTIONAL	ATP, FLIGHT INSTR., AGE 41, 5806 TOTAL HOURS, 34 IN TYPE, INSTRUMENT RATED.
	TIME - 1259		N1700U	PX- 0 0 0	DUAL	
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		

NAME OF AIRPORT - WAUKEGAN MEMORIAL
DEPARTURE POINT
WAUKEGAN, IL
INTENDED DESTINATION
LOCAL
TYPE OF ACCIDENT
ENGINE FAILURE OR MALFUNCTION
COLLIDED WITH: TREES
PHASE OF OPERATION
TAKEOFF: INITIAL CLIMB
LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
POWERPLANT - MISCELLANEOUS: POWERPLANT FAILURE FOR UNDETERMINED REASONS
FACTOR(S)
TERRAIN - HIGH OBSTRUCTIONS
MISCELLANEOUS - EVASIVE MANEUVER TO AVOID COLLISION
COMPLETE POWER LOSS - COMPLETE ENGINE FAILURE/FLAMEOUT-1 ENGINE
EMERGENCY CIRCUMSTANCES - FORCED LANDING OFF AIRPORT ON LAND
REMARKS- PLTS RPRTD L ENG FAILED APRX 200FT AGL, UN TO MAINT ALT WHILE FEATHERING ENG & DTRMG GEAR PSN.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-2391	80/7/15	WAUKEGAN,IL	LEAR JET 23	CR- 0 0 2	COMMERCIAL	ATP,FLIGHT INSTR.; AGE 31, 5440 TOTAL HOURS, 147d IN TYPE, INSTRUMENT RATED.
	TIME - 2000		N126P	PX- 0 0 5	AIR TAXI-PASSG	
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		

NAME OF AIRPORT - WAUKEGAN MEMORIAL
DEPARTURE POINT: ASPEN,CO — INTENDED DESTINATION: WHEELING,IL
TYPE OF ACCIDENT: COLLIDED WITH: OBJECT — PHASE OF OPERATION: LANDING: ROLL

PROBABLE CAUSE(S)
PILOT IN COMMAND - SELECTED UNSUITABLE TERRAIN
PILOT IN COMMAND - FAILED TO INITIATE GO-AROUND
FACTOR(S)
AIRPORTS/AIRWAYS/FACILITIES - AIRPORT CONDITIONS: WET RUNWAY
MISCELLANEOUS ACTS,CONDITIONS - HYDROPLANING ON WET RUNWAY
MISCELLANEOUS ACTS,CONDITIONS - RAN OFF END OF RUNWAY
REMARKS- AIMED LNDG ON 4600FT WET RWY.COMPUTED LNDG DIST APRX 4620FT.

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-3031	81/1/2	WAUKEGAN,IL	CESSNA 310J	CR- 0 0 2	INSTRUCTIONAL	COMMERCIAL, AGE 29, 1060 TOTAL HOURS, 9 IN TYPE, INSTRUMENT RATED.
	TIME - 1730		N3095L	PX- 0 0 0	DUAL	
			DAMAGE-SUBSTANTIAL	OT- 0 0 0		

NAME OF AIRPORT - WAUKEGAN
DEPARTURE POINT: WAUKEGAN,IL — INTENDED DESTINATION: LOCAL
TYPE OF ACCIDENT: WHEELS-UP — PHASE OF OPERATION: LANDING: LEVEL OFF/TOUCHDOWN

PROBABLE CAUSE(S)
DUAL STUDENT - FAILED TO EXTEND LANDING GEAR
PILOT IN COMMAND - INADEQUATE SUPERVISION OF FLIGHT
FACTOR(S)
MISCELLANEOUS ACTS,CONDITIONS - SIMULATED CONDITIONS
REMARKS- SIMULATED SINGLE-ENG LDG.PLT RCVG BFR.

National Transportation Safety Board
Washington, D.C. 20594

Brief of Incident

File No. - 5053 4/05/82 WAUKEGAN,IL A/C Reg. No. N69341 Time (Lcl) - 1230 CST

---Basic Information---

Type Operating Certificate-AIR CARRIER
ON-DEMAND AIR TAXI
Type of Operation -NON SCHED,DOMESTIC,PASSENGER
Flight Conducted Under -14 CFR 135
Incident Occurred During -LANDING

Aircraft Damage
MINOR
Fire
NONE

Injuries	Fatal	Serious	Minor	None
Crew	0	0	0	1
Pass	0	0	0	2

---Aircraft Information---

Make/Model - CESSNA 402B
Landing Gear - TRICYCLE-RETRACTABLE
Max Gross Wt - 6300
No. of Seats - 8

Eng Make/Model - CONTINENTAL TSIO-520-E
Number Engines - 2
Engine Type - RECIP - FUEL INJECTED
Rated Power - 300 HP

ELT Installed/Activated - YES/NO
Stall Warning System - YES
Weather Radar - UNK/NR

---Environment/Operations Information---

Weather Data
Wx Briefing - FSS
Method - UNK/NR
Completeness - UNK/NR
Basic Weather - IMC
Wind Dir/Speed- 050/030 KTS
Visibility - 1.500 SM
Cloud Conditions(1st) - 1000 FT UNK/NR
Cloud Conditions(2nd) - UNK/NR
Obstruction to Vision- BLOWING SNOW
Precipitation - SNOW
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
KALAMAZOO,MI
Destination
WAUKEGAN,IL

ATC/Airspace
Type of Flight Plan - IFR
Type of Clearance - NONE
Type Arch/Lnds - CIRCLING

Airport Proximity
OFF AIRPORT/STRIP

Airport Data
WAUKEGAN MEMORIAL
Runway Ident - 05
Runway Lth/Wid - 4600/ 150
Runway Surface - CONCRETE
Runway Status - UNK/NR

---Personnel Information---

Pilot-In-Command
Certificate(s)/Rating(s)
ATP
SE LAND,ME LAND

Age - 38
Biennial Flight Review
Current - YES
Months Since - 0
Aircraft Type - UNK/NR

Medical Certificate - VALID MEDICAL-NO WAIVERS/LIMIT

Flight Time (Hours)

Total -	2311	Last 24 Hrs -	2
Make/Model-	748	Last 30 Days-	UNK/NR
Instrument-	548	Last 90 Days-	114
Multi-Eng -	748		

Instrument Rating(s) - AIRPLANE

---Narrative---

PILOT REPORTED AN OIL LEAK IN THE RIGHT ENGINE TO CONTROLLER WHILE ON AN INSTRUMENT APPROACH TO WAUKEGAN AIRPORT. SEVERAL MINUTES LATER, PILOT REPORTED THAT HE HAD LOST SIGHT OF THE AIRPORT AND DUE TO LOSS OF POWER IN THE RIGHT ENGINE, ELECTED TO LAND IN A PLOWED FIELD. ON LANDING, THE GEAR COLLAPSED. EXAMINATION OF THE RIGHT ENGINE OIL SCAVENGE PUMP REVEALED THAT THE DRIVE GEAR WAS FRACTURED INTO FIVE PIECES. FOUR OF THE FIVE FRACTURES BORE EVIDENCE OF AN OVERLOAD TYPE FAILURE. ONE FRACTURE SURFACE EXAMINED WAS DETERMINED TO HAVE BEEN PRE-EXISTING AN IT BORE EVIDENCE OF A FATIGUE TYPE FAILURE.

File No. - 5053 4/05/82 WAUKEGAN,IL A/C Reg. No. N69341 Time (Lcl) - 1230 CST

Occurrence #1 LOSS OF POWER(TOTAL) - MECH FAILURE/MALFUNCTION
Phase of Operation APPROACH - CIRCLING(IFR)

Finding(s)
1. LUBRICATING SYSTEM,OIL SCAVENGE PUMP - FAILURE,TOTAL
2. FLUID,OIL - LOSS,TOTAL

Occurrence #2 FORCED LANDING
Phase of Operation APPROACH - CIRCLING(IFR)

Occurrence #3 GEAR COLLAPSED
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
3. LANDING GEAR - OVERLOAD

---Probable Cause---

The National Transportation Safety Board determines that the Probable Cause(s) of this incident is/are finding(s) 3

Factor(s) relating to this incident is/are finding(s) 1,2

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - 177 3/14/83 WAUKEGAN, IL A/C Reg. No. N46509 Time (Lcl) - 1740 CDT

---Basic Information---

Type Operating Certificate-NONE (GENERAL AVIATION)
Type of Operation -INSTRUCTIONAL
Flight Conducted Under -14 CFR 91
Accident Occurred During -LANDING

Aircraft Damage: SUBSTANTIAL
Fire: NONE

Injuries	Fatal	Serious	Minor	None
Crew	0	0	0	1
Pass	0	0	0	0

---Aircraft Information---

Make/Model - CESSNA 152
Landing Gear - TRICYCLE-FIXED
Max Gross Wt - 1650
No. of Seats - 2

Eng Make/Model - LYCOMING O-235
Number Engines - 1
Engine Type - RECIPROCATING-CARBURETOR
Rated Power - 125 HP

ELT Installed/Activated - YES/YES
Stall Warning System - YES

---Environment/Operations Information---

Weather Data
Wx Briefing - NO RECORD OF BRIEFING
Method - N/A
Completeness - N/A
Basic Weather - VMC
Wind Dir/Speed- 310/010 KTS
Visibility - 10.0 SM
Lowest Sky/Clouds - CLEAR
Lowest Ceiling - NONE
Obstructions to Vision- NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
SAME AS ACC/INC

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lnds - TRAFFIC PATTERN
FULL STOP

Airport Proximity
ON AIRPORT

Airport Data
WAUKEGAN
Runway Ident - 20
Runway Lth/Wid - 3750/ 100
Runway Surface - ASPHALT
Runway Status - DRY

---Personnel Information---

Pilot-In-Command
Certificate(s)/Rating(s)
STUDENT

Age - 36
Biennial Flight Review
Current - N/A
Months Since - N/A
Aircraft Type - N/A

Medical Certificate - VALID MEDICAL-NO WAIVERS/LIMIT

Flight Time (Hours)			
Total -	29	Last 24 Hrs -	1
Make/Model-	29	Last 30 Days-	UNK/NR
Instrument-	0	Last 90 Days-	22

Instrument Rating(s) - NONE

---Narrative---

THE STUDENT PILOT MADE A HARD LANDING ON HIS FIRST SOLO FLIGHT. THE AIRCRAFT BOUNCED SEVERAL TIMES AND DAMAGED THE NOSE LANDING GEAR. THE STUDENT HAD MADE FOUR FULL STOP LANDINGS WITH AN INSTRUCTOR PILOT. THEN THE INSTRUCTOR DEPLANED FOR THE STUDENT TO MAKE HIS FIRST SOLO FLIGHT. DURING THE FIRST LANDING ATTEMPT THE ACFT LANDING NOSE GEAR FIRST WHICH RESULTED IN SEVERAL BOUNCES BEFORE THE ACFT CAME TO REST ON THE NOSE WITH THE NOSE WHEEL TOWARD THE REAR. THE LANDING RUNWAY WAS 32 AND THE WIND WAS 310 DEGREES AT 10 KTS WITH GUSTS.

File No. - 177 3/14/83 WAUKEGAN,IL A/C Reg. No. N46509 Time (Lcl) - 1740 CDT

Occurrence #1 HARD LANDING
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
1. WEATHER CONDITION - GUSTS
2. FLARE - MISJUDGED - PILOT IN COMMAND
3. IMPROPER USE OF PROCEDURE,LACK OF TOTAL EXPERIENCE IN TYPE OPERATION - PILOT IN COMMAND
4. RECOVERY FROM BOUNCED LANDING - IMPROPER - PILOT IN COMMAND

Occurrence #2 NOSE GEAR COLLAPSED
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
5. LANDING GEAR,NOSE GEAR ASSEMBLY - OVERLOAD

----Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 2,3,4

Factor(s) relating to this accident is/are finding(s) 1,5

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - 1974 6/12/83 WAUKEGAN,IL A/C Reg. No. N48245 Time (Lcl) - 1330 CDT

---Basic Information----
Type Operating Certificate-NONE (GENERAL AVIATION)

Type of Operation -INSTRUCTIONAL
Flight Conducted Under -14 CFR 91
Accident Occurred During -LANDING

Aircraft Damage
SUBSTANTIAL
Fire
NONE

	Injuries			
	Fatal	Serious	Minor	None
Crew	0	0	0	2
Pass	0	0	0	0

---Aircraft Information----
Make/Model - PIPER PA-32-260
Landing Gear - TRICYCLE-FIXED
Max Gross Wt - 3400
No. of Seats - 7

Eng Make/Model - LYCOMING O-540-E4B5
Number Engines - 1
Engine Type - RECIPROCATING-CARBURETOR
Rated Power - 260 HP

ELT Installed/Activated - YES/NO
Stall Warning System - YES

---Environment/Operations Information----
Weather Data
Wx Briefing - NO RECORD OF BRIEFING
Method - N/A
Completeness - N/A
Basic Weather - VMC
Wind Dir/Speed- 190/012 KTS
Visibility - 15.0 SM
Lowest Sky/Clouds - CLEAR
Lowest Ceiling - NONE
Obstructions to Vision- NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
LOCAL

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lndg - TRAFFIC PATTERN
TOUCH AND GO

Airport Proximity
ON AIRPORT

Airport Data
WAUKEGAN MEMORIAL
Runway Ident - 23
Runway Lth/Wid - 4600/ 150
Runway Surface - CONCRETE
Runway Status - DRY

---Personnel Information----
Pilot-In-Command
Certificate(s)/Rating(s)
COMMERCIAL,CFI
SE LAND

Instrument Rating(s) - AIRPLANE

Age - 34
Biennial Flight Review
Current - YES
Months Since - 13
Aircraft Type - UNK/NR

Medical Certificate - VALID MEDICAL-NO WAIVERS/LIMIT

Flight Time (Hours)			
Total -	753	Last 24 Hrs -	UNK/NR
Make/Model-	6	Last 30 Days-	UNK/NR
Instrument-	26	Last 90 Days-	24
Multi-Eng -	1		

---Narrative----
THE STUDENT WAS RECEIVING A HIGH PERFORMANCE CHECKOUT. DURING THE THIRD LANDING THE ACFT LANDED HARD.

File No. - 1974 6/12/83 WAUKEGAN,IL A/C Reg. No. N48245 Time (Lcl) - 1330 CDT

Occurrence HARD LANDING
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
1. LEVEL OFF - IMPROPER - DUAL STUDENT
2. SUPERVISION - INADEQUATE - PILOT IN COMMAND(CFI)
3. IMPROPER USE OF EQUIPMENT/AIRCRAFT,LACK OF TOTAL EXPERIENCE IN TYPE OF AIRCRAFT - PILOT IN COMMAND(CFI)

---Probable Cause---

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 1,2

Factor(s) relating to this accident is/are finding(s) 3

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - 25 1/14/84 WAUKEGAN,IL A/C Reg. No. N2378I Time (Lcl) - 1100 CST

--Basic Information----
Type Operating Certificate-NONE (GENERAL AVIATION)
Type of Operation -INSTRUCTIONAL
Flight Conducted Under -14 CFR 91
Accident Occurred During -LANDING

Aircraft Damage
SUBSTANTIAL

		Injuries			
		Fatal	Serious	Minor	None
Fire	Crew	0	0	0	1
NONE	Pass	0	0	0	0

---Aircraft Information----
Make/Model - PIPER PA-38-112
Landing Gear - TRICYCLE-FIXED
Max Gross Wt - 1670
No. of Seats - 2
Eng Make/Model - LYCOMING O-235-L2C
Number Engines - 1
Engine Type - RECIPROCATING-CARBURETOR
Rated Power - 112 HP
ELT Installed/Activated - YES/NO
Stall Warning System - YES

--Environment/Operations Information----
Weather Data
Wx Briefing - UNK/NR
Method - UNK/NR
Completeness - UNK/NR
Basic Weather - VMC
Wind Dir/Speed- 320/010 KTS
Visibility - 7.0 SM
Lowest Sky/Clouds - CLEAR
Lowest Ceiling - NONE
Obstructions to Vision- NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
LOCAL

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lnds - TRAFFIC PATTERN
FULL STOP

Airport Proximity
ON AIRPORT

Airport Data
WAUEGAN MEMORIAL
Runway Ident - 32
Runway Lth/Wid - 3750/ 75
Runway Surface - CONCRETE
Runway Status - SNOW - CRUSTED

---Personnel Information----
Pilot-In-Command
Certificate(s)/Rating(s)
STUDENT

Age - 34
Biennial Flight Review
Current - N/A
Months Since - N/A
Aircraft Type - N/A

Medical Certificate - VALID MEDICAL-WAIVERS/LIMI
Flight Time (Hours)

Total	24	Last 24 Hrs	UNK/NR
Make/Model	24	Last 30 Days	UNK/NR
Instrument	UNK/NR	Last 90 Days	17
Multi-Eng	UNK/NR	Rotorcraft	UNK/NR

Instrument Rating(s) - NONE

---Narrative---
THE STUDENT PLT SAID HE LOST TOO MUCH AIRSPEED DURING A NO POWER APPROACH AND MADE A HARD LANDING. AFTER A BOUNCE, THE ACFT HIT ON THE NOSE GEAR AND IT COLLAPSED. THE ACFT SKIDDED OFF THE RWY INTO A SNOWBANK.

File No. - 25 1/14/84 WAUKEGAN,IL A/C Reg. No. N2378I Time (Lcl) - 1100 CST

Occurrence #1 HARD LANDING
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
1. FLARE - IMPROPER - PILOT IN COMMAND
2. RECOVERY FROM BOUNCED LANDING - IMPROPER - PILOT IN COMMAND

Occurrence #2 NOSE GEAR COLLAPSED
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
1. LANDING GEAR,NOSE GEAR - OVERLOAD

---Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 1,2

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - [illegible] 11/23/84 WAUKEGAN,IL A/C Reg. No. N53134 Time (Lct) - 1015 CST

----Basic Information----
Type Operating Certificate-NONE (GENERAL AVIATION)
Type of Operation -TEST FLIGHT
Flight Conducted Under -14 CFR 91
Accident Occurred During -LANDING

Aircraft Damage
SUBSTANTIAL
Fire
NONE

	Injuries			
	Fatal	Serious	Minor	None
Crew	0	0	0	1
Pass	0	0	0	0

----Aircraft Information----
Make/Model - CESSNA 172P
Landing Gear - TRICYCLE-FIXED
Max Gross Wt - 2150
No. of Seats - 4
Eng Make/Model - LYCOMING O-320-D2J
Number Engines - 1
Engine Type - RECIPROCATING-CARBURETOR
Rated Power - 160 HP
ELT Installed/Activated - YES/YES
Stall Warning System - YES

----Environment/Operations Information----
Weather Data
Wx Briefing - NO RECORD OF BRIEFING
Method - N/A
Completeness - N/A
Basic Weather - VMC
Wind Dir/Speed- CALM
Visibility - [illegible] SM
Lowest Sky/Clouds - 25000 FT SCATTERED
Lowest Ceiling - NONE
Obstructions to Vision- HAZE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
WAUKEGAN,IL
Destination
SAME AS ACC/INC

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lndg - FORCED LANDING

Airport Proximity
ON AIRPORT

Airport Data
WAUKEGAN MEMORIAL
Runway Ident - 23
Runway Lth/Wid - 4600/ 150
Runway Surface - DIRT
Runway Status - DRY

----Personnel Information----
Pilot-In-Command
Certificate(s)/Rating(s)
COMMERCIAL,CFI
SE LAND,ME LAND

Age - 42
Biennial Flight Review
Current - YES
Months Since - 9
Aircraft Type - UNK/NR

Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT

Flight Time (Hours)

Total -	1996	Last 24 Hrs -	UNK/NR
Make/Model-	900	Last 30 Days-	UNK/NR
Instrument-	345	Last 90 Days-	55
Multi-Eng -	15		

Instrument Rating(s) - AIRPLANE

----Narrative----
THE ACFT COLLIDED WITH THE TERRAIN DURING A FORCED LANDING FOLLOWING A LOSS OF POWER DURING TAKEOFF. INVESTIGATION REVEALED THAT TWO DAYS PREVIOUSLY A LOSS OF POWER HAD OCCURED DURING A TEST FLT WHICH WAS VIRTUALLY IDENTICAL TO THE POWER LOSS EXPERIENCED DURING THIS ACCIDENT ONLY THE PLT HAD SUFFICIENT ALT TO EXECUTE A 180 DEG TURN AND LAND BACK ON THE RWY. AFTER THIS FLT HEET (DRY ICE) WAS ADDED TO EACH FUEL TANK. ANALYSIS OF THE LIQUID DRAINED FROM THE ACFT FOLLOWING THE ACC REVEALED A MIXTURE OF WATER AND METHANOL. METHANOL IS THE MAIN INGREDIENT OF HEET. THE ACFT ENG & CARB HEET SYSTEM OPERATED NORMALLY.

File No. - [illegible] 11/23/94 WAUKEGAN,IL A/C Reg. No. N5313A Time (Lcl) - 1015 CST

Occurrence #1 LOSS OF POWER(TOTAL) - NON-MECHANICAL
Phase of Operation TAKEOFF - INITIAL CLIMB

Finding(s)
1. FLUID,FUEL - WATER
2. AIRCRAFT PREFLIGHT - INADEQUATE - PILOT IN COMMAND
3. FLUID,ANTI-ICE ADDITIVE - IMPROPER
4. MAINTENANCE,INSPECTION OF AIRCRAFT - INADEQUATE - PILOT IN COMMAND
5. PROCEDURES/DIRECTIVES - IMPROPER - COMPANY/OPERATOR MGMT
6. REMEDIAL ACTION - ATTEMPTED - PILOT IN COMMAND

Occurrence #2 ON GROUND COLLISION WITH TERRAIN
Phase of Operation LANDING - ROLL

Finding(s)
7. TERRAIN CONDITION - MOUNTAINOUS/HILLY
8. TERRAIN CONDITION - ROUGH/UNEVEN
9. TERRAIN CONDITION - HIGH VEGETATION

----Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 2,4,5

Factor(s) relating to this accident is/are finding(s) 1,3

Washington, D.C. 20594

Brief of Accident

File No. - [illegible] 5/12/[illegible] WAUKEGAN,IL A/C Reg. No. N1343F Time (Lcl) - 1750 CDT

----Basic Information----

Type Operation Certificate-NONE (GENERAL AVIATION)

Type of Operation -TESTING
Flight Conducted Under -14 CFR 91
Accident Occurred During -LANDING

Aircraft Damage
SUBSTANTIAL
Fire
NONE

	Fatal	Serious	Minor	None
Crew	0	0	0	1
Pass	0	0	0	0

----Aircraft Information----

Make/Model - GRUMMAN TIGER AG CAT
Landing Gear - TAILWHEEL-ALL FIXED
Max Gross Wt - 920
No. of Seats - 1

Eng Make/Model - LYCOMING O-320-E2D
Number Engines - 1
Engine Type - RECIPROCATING-CARBURETOR
Rated Power - 150 HP

ELT Installed/Activated - NO -N/A
Stall Warning System - NO

----Environment/Operations Information----

Weather Data
Wx Briefing - FSS
Method - TELEPHONE
Completeness - WEATHER NOT PERTINENT
Basic Weather - VMC
Wind Dir/Speed - 030/010 KTS
Visibility - 7.0 SM
Lowest Sky/Clouds - UNK/NR SCATTERED
Lowest Ceiling - UNK/NR BROKEN
Obstructions to Vision - NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
SAME AS ACC/INC

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lndg - STOP AND GO
FORCED LANDING

Airport Proximity
ON AIRPORT

Airport Data
WAUKEGAN
Runway Ident - 05
Runway Lth/Wid - 4500/ 150
Runway Surface - DIRT
Runway Status - SOFT

----Personnel Information----

Pilot-In-Command
Certificate(s)/Rating(s)
PRIVATE
SF LAND
GLIDER

Age - 58
Biennial Flight Review
Current - YES
Months Since - 10
Aircraft Type - C-150

Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT

Instrument Rating(s) - NONE

Flight Time (Hours)

Total -	136	Last 24 Hrs -	8
Make/Model-	14	Last 30 Days-	2
Instrument-	9	Last 90 Days-	2
Multi-Eng -	2	Rotorcraft -	UNK/NR

----Narrative----

THE ACFT CRASH LANDED IN A CULTIVATED PART OF THE ARPT AFTER THE ENG QUIT DURING TAKEOFFS & LANDINGS. THE ACFT CLIMBED TO ABOUT 600 FT AGL AND STARTED A TURN WHEN THE ENG STOPPED. THE ACFT WAS GLIDED TO AN ALFALFA FIELD ON THE ARPT. THE ACFT WAS DAMAGED DURING LANDING.

File No. [illegible] [illegible] WAUK [illegible]IL A/C Reg. No. N[illegible]E Time (Lcl) - 1750 CDT

Occurrence: 1 [illegible]
Phase of Operation [illegible]

Finding(s)
1. [illegible]

Occurrence: [illegible] FORCED LANDING
Phase of Operation DESCENT - EMERGENCY

Occurrence: [illegible] HARD LANDING
Phase of Operation LANDING - FLARE/TOUCHDOWN

----Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 1

Brief of Accident

File No. - [illegible] 4/20/87 WAUKEGAN,IL A/C Reg. No. N24739 Time (Lcl) - 0855 CDT

---- Basic Information ----

Type Operation Certificate-ON-DEMAND AIR TAXI

Type of Operation -INSTRUCTIONAL
Flight Conducted Under -14 CFR 91
Accident Occurred During -LANDING

Aircraft Damage
SUBSTANTIAL
Fire

	Injuries			
	Fatal	Serious	Minor	None
Crew	0	0	2	0
Pass	0	0	0	0

UNK/NR

----Aircraft Information----

Make/Model - CESSNA 152
Landing Gear - TRICYCLE-FIXED
Max Gross Wt - 1670
No. of Seats - 2

Eng Make/Model - LYCOMING O-235-N2C
Number Engines - 1
Engine Type - RECIPROCATING-CARBURETOR
Rated Power - 108 HP

ELT Installed/Activated - YES/YES
Stall Warning System - YES

---- Environment/Operations Information----

Weather Data
Wx Briefing - UNK/NR
Method - UNK/NR
Completeness - UNK/NR
Basic Weather - VMC
Wind Dir/Speed- 320/005 KTS
Visibility - 4.0 SM
Lowest Sky/Clouds - 7000 FT SCATTERED
Lowest Ceiling - UNK/NR
Obstructions to Vision- HAZE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
SAME AS ACC/INC

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lndg - TRAFFIC PATTERN
TOUCH AND GO

Airport Proximity
ON AIRPORT

Airport Data
WAUKEGAN REG.
Runway Ident - 32
Runway Lth/Wid - 3750/ 75
Runway Surface - CONCRETE
Runway Status - DRY

----Personnel Information----

Pilot-In-Command
Certificate(s)/Rating(s)
COMMERCIAL,CFI
SE LAND,ME LAND

Age - 25
Biennial Flight Review
Current - YES
Months Since - 11
Aircraft Type - UNK/NR

Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT

Flight Time (Hours)

Total	776	Last 24 Hrs	2
Make/Model	450	Last 30 Days	UNK/NR
Instrument	54	Last 90 Days	149
Multi-Eng	80		

Instrument Rating(s) - AIRPLANE

----Narrative----

WHILE ON FINAL APPROACH JUST PAST THE THRESHOLD OF RUNWAY 32 AT ABOUT 10 FEET AGL, A HELICOPTER CROSSED IN FRONT OF THE CESSNA 152. THE STUDENT PILOT ADDED POWER AND PULLED BACK ON THE YOKE. THE INSTRUCTOR PILOT THEN TOOK THE CONTROL AND BEGAN TO LET THE NOSE DOWN AND WINGS LEVEL BUT THE PLANE STRUCK THE GROUND.

File No. - [illegible] SEA87FA [illegible] A/C Reg. No. N74753 Time (Lcl) - 0855 CDT

Occurrence #1 ABORT MANEUVER
Phase of Operation APPROACH - VFR PATTERN - FINAL APPROACH

Finding(s)
1. OBJECT - AIRCRAFT MOVING ON GROUND
2. VISUAL LOOKOUT - POOR - PILOT OF OTHER AIRCRAFT
3. REMEDIAL ACTION - ATTEMPTED - DUAL STUDENT
4. FLARE - MISJUDGED - DUAL STUDENT
5. SUPERVISION - INADEQUATE - PILOT IN COMMAND(CFI)

Occurrence #2 LOSS OF CONTROL - IN FLIGHT
Phase of Operation APPROACH - VFR PATTERN - FINAL APPROACH

Finding(s)
6. STALL - INADVERTENT - DUAL STUDENT
7. REMEDIAL ACTION - ATTEMPTED - PILOT IN COMMAND(CFI)
8. REMEDIAL ACTION - NOT POSSIBLE - PILOT IN COMMAND(CFI)
9. ALTITUDE - INADEQUATE - PILOT IN COMMAND(CFI)

Occurrence #3 HARD LANDING
Phase of Operation LANDING - FLARE/TOUCHDOWN

---Probable Cause---

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 1,2,3,4,5,6

Factor(s) relating to this accident is/are finding(s) 7,8

LIST OF ABBREVIATIONS USED IN BRIEFS

ABBREVIATION	MEANING
AERIAL ADVERTISE	AERIAL ADVERTISING
ATP/FLIGHT INSTR.	AIRLINE TRANSPORT INSTRUCTOR
AIR SHOW/RACING	AIR SHOW/AIR RACING
AIR TAXI-CARGO	AIR TAXI-CARGO OPERATIONS
AIR TAXI-PASSG	AIR TAXI-PASSENGER OPERATIONS
APPROACH CTL-DEPARTURE	APPROACH CONTROL-DEPARTURE
APR CTL-TOW ENRT CTL SRV	APPROACH CONTROL-TOWER EN ROUTE CONTROL SERVICE
ASSOC CROP CTL ACTIVITIES	ASSOCIATED CROP CONTROL ACTIVITIES
ASSOC FIRE CTL ACTIVITIES	ASSOCIATED FIRE CONTROL ACTIVITIES
COMMERCIAL/FLIGHT.INSTR	COMMERCIAL FLIGHT INSTRUCTOR
CORP/EXEC	CORPORATION/EXECUTIVE
CR-	CREW
CTR CARGO-D	CONTRACT/CHARTER-CARGO-DOMESTIC
CTR CARGO-I	CONTRACT/CHARTER-CARGO-INTERNATIONAL
CTR PASSG-D	CONTRACT/CHARTER-PASSENGER-DOMESTIC
CTR PASSG-I	CONTRACT/CHARTER-PASSENGER-INTERNATIONAL
LAST ENROUTE STOP	LAST PLANNED EN ROUTE LANDING POINT
MAPPING/PHOTO	AERIAL MAPPING/PHOTOGRAPHY
MIL CONTRACT CARGO INTL	MILITARY CONTRACT-CARGO-INTERNATIONAL
MIL CONTRACT PASSG INTL	MILITARY CONTRACT-PASSENGER-INTERNATIONAL
MILITARY CTR CARGO DOM	MILITARY CONTRACT-CARGO-DOMESTIC
MILITARY CTR PASSG DOM	MILITARY CONTRACT-PASSENGER-DOMESTIC
MIL/CTR CARGO	MILITARY CONTRACT-CARGO
MIL/CTR PASSG	MILITARY CONTRACT-PASSENGER
NR.	NEAR
NS CTR CARGO	NONSCHEDULED/CHARTER REVENUE CARGO-INTRA-STATE
NS CTR PASSG	NONSCHEDULED/CHARTER REVENUE PASSENGER-INTRA-STATE
NS CTR REVENUE CARGO DOM	NONSCHEDULED/CHARTER REVENUE CARGO-DOMESTIC
NS CTR REVENUE CARGO INTL	NONSCHEDULED/CHARTER REVENUE CARGO-INTERNATIONAL
NS CTR REVENUE PASSG DOM	NONSCHEDULED/CHARTER REVENUE PASSENGER-DOMESTIC
NS CTR REVENUE PASSG INTL	NONSCHEDULED/CHARTER REVENUE PASSENGER-INTERNATL
OT-	OTHER AIRCRAFT AND GROUND
PARAJUMP	PARACHUTE JUMP
PRIVATE/FL.INST R.	PRIVATE FLIGHT INSTRUCTOR
PX-	PASSENGERS
RADAR CTL/SURVEILLANCE	RADAR CONTROL/SURVEILLANCE
SCHED CARGO SRV	SCHEDULED CARGO SERVICE
SCHED DOM PASSG SRV	SCHEDULED DOMESTIC PASSENGER SERVICE
SCHED DOM CARGO SRV	SCHEDULED DOMESTIC CARGO SERVICE
SCHED INTERNATL CARGO SRV	SCHEDULED INTERNATIONAL CARGO SERVICE
SCHED INTERNATL PASSG SRV	SCHEDULED INTERNATIONAL PASSENGER SERVICE
SCHED PASSG SRV	SCHEDULED PASSENGER SERVICE
S-D	SCHEDULED DOMESTIC
S-I	SCHEDULED INTERNATIONAL
UNK/NR	UNKNOWN/NOT REPORTED