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ANALYSIS/MODEL COVER SHEET
Complete Only Applicable Items

1. QA: QA

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3. ☐ Model — ☐ Conceptual Model Documentation; ☐ Model Documentation; ☐ Model Validation Documentation

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OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL REVISION RECORD

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TABLES

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1. PURPOSE

This analysis establishes the parameters associated with a design basis wind and a design basis tornado (including tornado-generated missile) per the direction provided in interoffice correspondence *LV.SA.KJM.05/99-064* (CRWMS M&O 1999a). These parameters will serve as the basis for the criteria that are developed to mitigate the effect of design basis winds and a design basis tornado on the structural stability of the Monitored Geological Repository (MGR) Surface Facilities. The primary systems that will contain criteria developed from this analysis include the HBS (Waste Handling Building), TBS (Waste Treatment Building), and CBS (Carrier Preparation Building).

A Preliminary Hazard Analysis performed in 1996 for the MGR screened out the majority of the postulated external storm events (CRWMS M&O 1996). The analysis was unable to screen out extreme winds and tornado related events.

2. QUALITY ASSURANCE

The Quality Assurance program applies to this analysis. The work reported in this document is part of the analysis of MGR design basis events (DBEs). The work performed for this analysis was evaluated according to QAP-2-0, *Conduct of Activities*. This evaluation determined that such activities are subject to *Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program* (DOE 1998) requirements.

This analysis is quality affecting because the results may be used to support analyses of repository structures, systems, and components per QAP-2-3, *Classification of Permanent Items*. This analysis is performed and documented in accordance with AP-3.10Q, *Analyses and Models*.

3. COMPUTER SOFTWARE AND MODEL USAGE

This analysis uses no computational software; therefore, this analysis is not subject to the software controls of the AP-SI.1Q series.

4. INPUTS

4.1 DATA AND PARAMETERS

4.1.1 Extreme Wind

All data related to extreme wind was obtained from the report entitled, *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997b).

4.1.2 Tornado

Tornado related data was obtained from the documents entitled, *Design Basis Tornado for Nuclear Power Plants* (Regulatory Guide 1.76) and *Tornado Climatology of the Contiguous United States* (Ramsdell and Andrews 1986).

4.2 CRITERIA

4.2.1 The Safety Analysis Report shall include:

A description of the Yucca Mountain site, with appropriate attention to those features, events, and processes of the site that might affect design of the geologic repository operations area and performance of the geologic repository (Dyer 1999).

4.2.2 Operating basis wind velocity (fastest mile of wind) should be based on the standard published by the American National Standards Institute (ANSI) with suitable corrections for local conditions (NRC 1987).

4.2.3 The basic wind speed is a 3-second gust with an annual probability of 0.02 of being equaled or exceeded (50-year mean recurrence interval) (ANSI 1996).

4.2.4 The wind used in the design shall be the most severe wind that has been historically reported to the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data has been accumulated (NRC 1987).

4.2.5 Meteorological conditions used as design and operating bases including:

100-year return period "fastest mile of wind" including vertical velocity distribution and gust factor (NRC 1987).

4.2.6 Meteorological conditions used as design and operating bases including:

Tornado parameters including translational speed, rotational speed, and the maximum pressure differential with the associated time interval (NRC 1987).

4.2.7 The tornado wind and associated missiles generated by the tornadic winds used in the design shall be the most severe wind that has been historically reported to the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data has been accumulated (NRC 1987).

4.2.8 Design basis tornado parameters should be based on Regulatory Guide 1.76.

4.3 CODES AND STANDARDS

Not Applicable.

5. ASSUMPTIONS

5.1 The criteria associated with extreme winds and tornadoes contained in the *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NRC 1987) will bound the criteria that will be contained in the Standard Review Plan for YMP. The basis for this assumption is engineering judgment that due to the smaller hazards associated with the proposed repository, criteria promulgated for nuclear power plants would bound those proposed in the Standard Review Plan for YMP. This assumption is used throughout Section 6.

5.2 This analysis assumed that applicable portions of the MGR surface facilities must be able to withstand a design basis tornado with a frequency of occurrence of 10^{-6} per year. This is consistent with the design basis for recently licensed nuclear facilities (DOE 1997) and with the level of protection required by the proposed 10 CFR 63 (Dyer 1999). This assumption is used in Section 6.2 and 7.1.

6. ANALYSIS

Currently, no regulations for design basis tornadoes or extreme winds have been promulgated for high-level nuclear waste sites. Therefore, the criteria used to develop the MGR design basis for those phenomena were taken from the guidance provided in NUREG-0800 (NRC 1987).

6.1 EXTREME WINDS

The typical method showing compliance with the design of structures that have to withstand the effects of extreme winds is provided in Sections 2.3.1 and 3.3.1 of *the Standard Review Plan for Nuclear Power Plants* (NRC 1987). The Standard Review Plan states that the 100-year return period "fastest mile of wind" including vertical velocity distribution and gust factor should be used and be based on the standard published by the American National Standards Institute (ANSI) with suitable corrections for local conditions. The current standard published by the American National Standards Institute is ANSI/ASCE 7-95, *Minimum Design Loads for Building and other Structures* (ANSI 1996). The basic wind speed defined in this document is a 3-second gust with an annual probability of 0.02 of being equaled or exceeded (50-year mean recurrence interval). Regional data can be used to determine the basic wind speed.

Wind speed data has been collected near the proposed MGR site (CRWMS M&O 1997b). This data includes observed maximum daily one-second gust and one-minute wind speed at 9 locations for the period 1993-1996. The magnitude of the 50-year and 100-year return wind speeds were also estimated from this site-specific data. The data shown in Table 1 corresponds to the location with the highest value in the meteorological monitoring network.

Table 1. Maximum Estimated and Observed Wind Speeds Near Yucca Mountain, Nevada (CRWMS M&O 1997b)

	Wind Speed (m/sec)[mph]	
	50-year, 3 second gust	100-year, 1 minute
Observed	40.22 [90]	33.16 [74]
Estimated	54.11 [121]	48.47 [109]

6.2 TORNADO

Data about tornado occurrences in the Great Basin area of Nevada, Utah, Arizona and portions of California was compiled in the document, *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997b). This report indicates that there were no tornadoes reported on the Nevada Test Site between 1916 and 1969 and only four within a 150-mile radius of the Nevada Test Site. Only 12 tornadoes were reported in the entire state of Nevada between 1959 and 1973.

Out of a total of 73 reported tornadoes in the Great Basin areas, 15 were in the F1 category (wind speed greater that 32 m/s (72 mph) but less than or equal to 50 m/s (112 mph)) and four were in the F2 category (wind speed greater that 50 m/s (112 mph) but less than or equal to 70 m/s (157 mph)) (CRWMS M&O 1997b). No F2 tornadoes were reported in the state of Nevada (CRWMS M&O 1997b). The other 54 reported tornadoes were in the F0 category, with speeds up to 32 m/s (72 mph). The tornado reported the closest to Yucca Mountain was in Amargosa Valley, approximately 50 km from Yucca Mountain. This F0 tornado occurred July 16, 1987 (CRWMS M&O 1997b).

The primary reason for these indications of infrequent and weak tornadoes near Yucca Mountain is the lack of proper meteorological conditions necessary for tornado formation. The prevailing dry conditions, plus the irregular, rough terrain tends to reduce the possibility of tornadoes (CRWMS M&O 1997b).

The typical method showing compliance with the design of structures that have to withstand the effects of design basis tornadoes is provided in the *Standard Review Plan for Nuclear Power Plants* (NRC 1987). The standard review plan states that Regulatory Guide 1.76, *Design Basis Tornado for Nuclear Power Plants* be used. Regulatory Guide 1.76 states that facilities "must be designed so that the plants remain in a safe condition in the event of the most severe tornado that can reasonably be predicted to occur at a site as a result of severe meteorological conditions." The design basis tornado characteristics provided by Regulatory Guide 1.76 are shown in Table 2.

Table 2. Design Basis Tornado Characteristics, (Regulatory Guide 1.76)

Region **	Maximum Speed* (mph)	Rotational Speed (mph)	Translational Speed (mph)		Radius of Maximum Rotational Speed (feet)	Pressure Drop (psi)	Rate of Pressure Drop (psi/sec)
			Max	Min			
I	360	290	70	5	150	3.0	2.0
II	300	240	60	5	150	2.25	1.2
III	240	190	50	5	150	1.5	0.6

* The maximum wind speed is the sum of the rotational speed component and the maximum translational speed component.

** Region refers to the three tornado intensity regions within the contiguous United States as listed in Figure 1 of Regulatory Guide 1.76. Region III applies to the area surrounding Yucca Mountain.

The source document for Regulatory Guide 1.76 is the United States Atomic Energy Commission publication *Technical Basis for Interim Regional Tornado Criteria*, WASH-1300, published in 1974 (NRC 1974). The design basis tornado characteristics in Table 2 are based on a tornado that has a probability of occurrence of 10^{-7} per year (Ramsdell and Andrews 1986).

Subsequent to the issuance of Regulatory Guide 1.76, the American Nuclear Society, through the American Nuclear Standards Institute (ANSI), published ANSI/ANS-2.3-1983, *Standard for Estimating Tornado and Extreme Wind Characteristics at Nuclear Power Sites* (ANSI 1983). This publication established "guidelines to estimate the frequency of occurrence and the magnitude of parameters associated with tornadoes, hurricanes and other extreme winds at nuclear power reactor sites." Figures were presented that showed regionalized tornado wind speed corresponding to a given probability. The information is summarized in Table 3. Although this publication expired in 1993, it represented the current state of knowledge on tornado and extreme wind characteristics at the time of publication (ANSI 1983).

Table 3. Tornado Wind Speed (miles per hour) by Region (ANSI/ANS-2.3-1983)

Region *	Probability of Occurrence per Year		
	10^{-5}	10^{-6}	10^{-7}
I	200	260	320
II	150	200	250
III	100	140	180

* Region III applies to the area surrounding Yucca Mountain.

In 1986, the NRC issued new guidance on tornado strike and intensity probabilities in NUREG/CR-4461, *Tornado Climatology of the Contiguous United States* (Ramsdell and Andrews 1986). The new guidance was based on 30 years of data contained in the National Severe Storms Forecast Center tornado database from the period of January 1, 1954 through

December 31, 1983. The report contains tornado characteristics including the number of occurrences, frequencies of occurrence, and average dimensions. Values are provided for 5° latitude and longitude boxes for the contiguous United States.

Table 4 lists the wind speeds provided for 10^{-5}, 10^{-6}, and 10^{-7} per year probabilities of occurrence for the 5° box containing Yucca Mountain. Both the nominal (expected) value and the value associated with the upper end of the 90% confidence interval for strike probabilities are shown. Statistically, this latter value is interpreted as the maximum value in a range that has a 90% chance of containing the true strike probability. The wind speed value (10^{-6} per year) selected for the MGR is 189 miles per hour.

Table 4. Tornado Wind Speed* (miles per hour) for 5° Box Containing Yucca Mountain, Nevada, (Ramsdell and Andrews 1986)

	Strike Probability of Occurrence per Year		
	10^{-5}	10^{-6}	10^{-7}
Nominal Wind Speed	-	131	NP
Upper 90% Wind Speed	151	189	189

NP – Not Provided.

* Wind speed is the sum of the translational and rotational components.

The pressure drop and the rate of pressure drop associated with a maximum tornado vortex (funnel) impacting a structure are two additional design basis tornado criteria needed for repository structural analyses. These values were not provided with the estimated maximum speed shown in Table 4.

Table 2 shows the Nuclear Regulatory Commission's Regulatory Guide 1.76 pressure terms corresponding to the wind speeds given for the three regions covering the United States. The table lists maximum tornado wind speeds, rotational speeds, maximum and minimum translation speeds, an assumed vortex radius of 150 feet, and the corresponding pressure drop and rate of pressure drop. The maximum pressure drop (pounds-force per square-inch) values can be calculated from the total and translation speeds using the equation (ANSI-1983):

$$\Delta P = 3.546 \times 10^{-5}\ V_t^2 \qquad \text{(Eq. 1)}$$

where:

V_t = V-T = the tangential wind speed at the edge of the vortex (speed of the funnel moving across the ground, in miles per hour).

V = maximum wind speed (189 mph from Table 4)

T = maximum translational speed

Using the average ratio of maximum tornado wind speed to the corresponding translation speed given in Regulatory Guide 1.76, the estimated translation speed for a tornado speed of 189 mph is 38 mph (56 feet/sec). Applying the above equation to these wind speeds yields an estimated pressure drop of 0.81 psi (pounds per square inch). The rate of pressure drop (psi/sec) can be calculated using the following:

$$\frac{dp}{dt} = \Delta P \times \frac{T}{R}$$

(Eq. 2)

where:

ΔP = pressure drop (psi)

T = maximum translational speed (feet/sec)

R = radius of tornado (feet)

Using the standard tornado vortex size of 150 feet, the corresponding rate of pressure drop is 0.3 psi/second.

6.3 TORNADO-GENERATED MISSILES

The typical method for demonstrating compliance with the design of structures that have to withstand the effects of tornado-generated missiles is provided in Sections 3.5.1.4 (*Missiles Generated By Natural Phenomena)* and 3.5.3 (*Barrier Design Procedures*) of the Standard Review Plan for Nuclear Power Plants (NRC 1987). Important-to-safety equipment must be protected against damage from missiles which might be generated by the design basis tornado.

Section 3.5.1.4 (*Missiles Generated By Natural Phenomena)* of NUREG-0800 (NRC 1987) requires that at least three objects must be postulated: a massive high kinetic energy missile that deforms on impact, a rigid missile to test penetration resistance, and a small rigid missile of a size sufficient to just pass through any openings in protective barriers. The Standard Review Plan (NRC 1987, Section 3.5.1.4) identifies two missile spectrums that will satisfy these criteria. Spectrum I missiles include: an 1800 Kg automobile, a 125 Kg 8" armor piercing artillery shell, and a 1" solid steel sphere. The impact speed required is 35% of the maximum horizontal wind speed of the design basis tornado. The first two missiles are to impact at normal incidence, the last to impinge upon barrier openings in the most damaging directions. Spectrum II missiles may be used as an alternative to Spectrum I missiles. Spectrum II missiles and associated horizontal speed are provided in Table 5.

Table 5. Spectrum II Missiles, (NRC 1987)

Missile	Mass (Kg)	Dimensions (m)	Velocity (m/sec)*
A. Wood Plank	52	.092 x .289 x 3.66	58
B. 6" Sch 40 pipe	130	.168D x 4.58	10
C. 1" Steel Rod	4	.0254D x .915	8
D. Utility Pole	510	.343D x 10.68	26
E. 12" Sch 40 pipe	340	.32D x 4.58	7
F. Automobile	1810	5 x 2 x 1.3	41

*Associated with Region III, Regulatory Guide 1.76.

Vertical velocities of 70% of the postulated horizontal velocities are used in both spectra except for the small missile in Spectrum I or missile C in Spectrum II. These missiles should have the same velocity in all directions. Missiles A, B, C and E are to be considered at all elevations and missiles D and F at elevations up to 30 feet above all grade levels within ½ mile of the facility structures.

Sufficient thickness of concrete or steel should be provided to prevent penetrations and in the case of concrete, prevent spalling or scabbing in case of missile impact. The minimum barrier thickness should not be less than the values shown in Table 6 (NRC 1987, Section 3.5.3).

Table 6. Minimum Acceptable Barrier Thickness Requirements for Local Damage Prediction Against Tornado Generated Missiles (NRC 1987)

Region III		
Concrete Strength (psi)	Wall Thickness (inches)	Roof Thickness (inches)
3000	6 (0.15 m)	6 (0.15 m)
4000	6 (0.15 m)	6 (0.15 m)
5000	6 (0.15 m)	6 (0.15 m)

6.4 AFFECTED SYSTEMS

The primary MGR surface facilities are the Carrier Preparation Building (CPB), the Waste Treatment Building (WTB), and the Waste Handling Building (WHB). The CPB structure consists of steel framing with insulated metal siding and roofing (CRWMS M&O 1997a). Concrete columns support the two 10-ton bridge cranes. Transportation casks are designed to withstand wind/tornado events and are not opened in the CPB. In the current design, the walls surrounding the systems in the WHB are 5 feet thick up to a height of thirty feet and 3 feet thick above thirty feet due to radiation shielding requirements and the roof is 8 to 10 inches thick (CRWMS M&O 1997a). The WTB, adjacent to the WHB carrier bay, is an open, high bay industrial structure. The main operating floor is a slab grade. The superstructure is a structural steel, braced frame with metal siding and metal deck roof. The Quality Level 1 (QL1) systems within these structures must be protected against extreme winds, tornadic winds, and tornado-generated missiles because of the potential to cause a radiological release. It is necessary to demonstrate that failure of any structure or component will not affect the capability of other structures or components to perform necessary safety functions.

Table 7 lists the QL1 systems that must be protected. The design criteria contained in Section 7 will be applied to the Waste Handling Building system, which will provide protection for the systems that are physically located in the Waste Handling Building (including the Assembly Transfer and the Canister Transfer systems). Both the Waste Emplacement and Waste Retrieval systems operate outside of the Waste Handling Building system. The tornado wind/missile design criteria are not applicable to these systems because administrative controls will prevent waste emplacement/retrieval operations during times when conditions are favorable for the occurrence of a tornado (e.g., during tornado watches or tornado warnings). The design basis wind criteria is applicable to both systems. No design criteria will be levied on the various disposal container systems since they are protected by either the Waste Handling Building or the Waste Emplacement/Retrieval Systems.

Table 7. QL1 Systems Affected

System Abbreviation	System	Sub System	Component	Reference
ATS	Assembly Transfer	Assembly Handling, Wet	Assembly Transfer Baskets	CRWMS M&O 1999b
ATS	Assembly Transfer	Assembly Handling, Wet	Basket Staging Racks	CRWMS M&O 1999b
CDC	Canistered SNF Disposal Container	N/A	N/A	CRWMS M&O 1999c
CTS	Canister Transfer	Canister Handling	Small Canister Staging Racks	CRWMS M&O 1999d
DDC	Defense High Level Waste Disposal Container	N/A	N/A	CRWMS M&O 1999e
EDC	DOE SNF Disposal Container	N/A	N/A	CRWMS M&O 1999f
HBS	Waste Handling Building	Waste Handling Building Structure	N/A	CRWMS M&O 1999g
NDC	Non-Fuel Components Disposal Container	N/A	N/A	CRWMS M&O 1999h
UDC	Uncanistered SNF Disposal Container	N/A	N/A	CRWMS M&O 1999i
VDC	Naval Spent Nuclear Fuel Disposal Container	N/A	N/A	CRWMS M&O 1999j
WES	Waste Emplacement	Locomotives	N/A	CRWMS M&O 1999k
WES	Waste Emplacement	Waste Package Transporter	N/A	CRWMS M&O 1999k
WRS	Waste Retrieval	N/A	N/A	CRWMS M&O 1999l

7. CONCLUSION

The parameters developed by this analysis will be incorporated into design criteria for the MGR.

The MGR design criteria for an extreme wind is 121 miles per hour (54.1 m/s). The extreme wind design criterion is bounded by the design basis tornado criteria provided in Table 8.

The proposed 10 CFR 63 (Dyer 1999) requires assurance of public safety to a level of 10^{-6} per year for infrequent events. Typically, the initiating event along with the subsequent sequence of events are used to determine the credibility of an event sequence. However, this analysis assumed that the MGR must be able to withstand a design basis tornado with a frequency of occurrence of 10^{-6} per year. This will ensure that a tornado-initiated sequence resulting in a radioactive release is categorized as a beyond design basis event.

The information provided in NUREG/CR-4461 (Ramsdell and Andrews 1986) represents the latest guidance on design basis tornadoes published by the Nuclear Regulatory Commission.

The guidance was used to determine the maximum wind speed of the design basis tornado, shown in Table 8. This value represents the upper end of the 90% confidence interval and reduces the uncertainty due to limited data sets associated with tornadic phenomena in western regions.

Table 8. Design Basis Parameters for Yucca Mountain

	Maximum Speed (mph)	Pressure Drop (psi)	Rate of Pressure Drop (psi/sec)
Extreme Wind	121	NA	NA
Tornado	189	0.81	0.3

Either the Spectrum I or Spectrum II missile spectrum may be used to design the MGR Surface Facilities for tornado-generated missiles. Design basis criteria for tornado-generated missiles are specified in Section 6.3 of this analysis. It may be desirable to conduct future analyses that determine whether the wind speed of the design basis tornado is sufficient to generate missiles with the entire generic missile spectrum. Portions of the missiles spectrum may be removed from the design basis missile spectrum if it is determined that they are not applicable to the location of the MGR surface facilities.

Attachment I

Document Input Reference Sheets

Attachment I: Document Input Reference Sheets

Document Identifier No./Rev.: ANL-MGR-SE-000001 REV 00			Change: N/A	Title: MGR Design Basis Extreme Wind/Tornado Analysis						
Input Document							TBV Due To			
No.	Technical Product Input Source Title & Identifiers with Version	Section	Input Status	Section Used In	Input Description	TBV/ TBD Priority	Unqual.	From Uncontrolled Source	Unconfirmed
1	ANSI 1983. *Standard for Estimating Tornado and Extreme Wind Characteristics at Nuclear Power Sites* ANSI/ANS-2.3-1983 Readily Available	Entire Figures 3.2-1, 3.2-2, 3.2-3 Footnote Table 3.3-1	N/A	6.2 Eq. 1	Guidance for Tornado	N/A	N/A	N/A	N/A
2	ANSI 1996. *Minimum Design Loads for Buildings and other Structures*, ANSI/ASCE 7-95, June 1996 Readily Available	6	N/A	6.1	Guidance on wind loads	N/A	N/A	N/A	N/A
3	CRWMS M&O 1996. *Preliminary MGDS Hazards Analysis*. REV. 00. B0000000-01717-0200-00130. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19961230.0011	7.1.3.10 7.1.3.43	N/A	1 1	Hazard analysis for extreme winds Hazard analysis for Tornado	N/A	N/A	N/A	N/A
4	CRWMS M&O 1997a. *Surface Nuclear Facilities Space Program Analysis*. BCBD00000-01717-0200-00012, REV. 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980112.0176.	Entire	N/A	6.4	General Reference	N/A	N/A	N/A	N/A
5	CRWMS M&O 1997b. *Engineering Design Climatology and Regional Meteorological Conditions Report*, B00000000-01717-5707-00066 REV 00. October 2, 1997. ACC: MOL.19980128.0103	Section 4.2.2.3 4.2.2.5	N/A	6.1 6.2	Historical Wind Data for Yucca Mountain	N/A	N/A	N/A	N/A

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No.	Technical Product Input Source Title & Identifiers with Version	Section	Input Status	Section Used In	Input Description	TBV/ TBD Priority	Unqual.	From Uncontrolled Source	Unconfirmed
6	QAP-2-0, Rev. 05. *Conduct of Activities*. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980826.0209	Entire	N/A	2	General Reference	N/A	N/A	N/A	N/A
7	CRWMS M&O 1999a. AP-3.10Q *Analysis Work Direction for MGR Extreme Wind/Tornado Analysis*. Interoffice Memorandum from D.W. Gwyn to T.D. Dunn. LV.SA.KJM.5/99-064. Las Vegas, Nevada. CRWMS M&O. ACC: MOL. 19990616.0087	Entire	N/A	2	General Reference	N/A	N/A	N/A	N/A
8	AP-SI.1Q, Rev. 01. *Software Management*. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990520.0164	Entire	N/A	2	General Reference	N/A	N/A	N/A	N/A
9	QAP- 2-3, Rev. 10. *Classification of Permanent Items*. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990316.0006.	Entire	N/A	2	General Reference	N/A	N/A	N/A	N/A
10	AP- 3.10Q, Rev. 1, ICN 0. *Analyses and Models*. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990702.0314.	Entire	N/A	2	General Reference	N/A	N/A	N/A	N/A
11	AP- 3.15Q, Rev. 0, ICN 1. *Managing Technical Product Inputs*. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990831.0079.	ALL	N/A	2	General Reference	N/A	N/A	N/A	N/A
12	CRWMS M&O 1999b. *Classification of the MGR Assembly Transfer System*, ANL-ATS-SE-000001 REV.00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0215	Entire	TBV-1196	Table 7	Classification of ATS as QL1	1	X	N/A	N/A

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No.	Technical Product Input Source Title & Identifiers with Version	Section	Input Status	Section Used In	Input Description	TBV/ TBD Priority	Unqual.	From Uncontrolled Source	Unconfirmed
13	CRWMS M&O 1999c. *Classification of the MGR Canistered SNF Disposal Container System*, ANL-CDC-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0143	Entire	N/A	Table 7	Classification of CDC as QL1	N/A	N/A	N/A	N/A
14	CRWMS M&O 1999d. *Classification of the MGR Canister Transfer System*, ANL-CTS-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0185	Entire	N/A	Table 7	Classification of CTS as QL1	N/A	N/A	N/A	N/A
15	CRWMS M&O 1999e. *Classification of the MGR Defense High Level Waste Disposal Container System*, ANL-DDC-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0142	Entire	N/A	Table 7	Classification of DDC as QL1	N/A	N/A	N/A	N/A
16	CRWMS M&O 1999f. *Classification of the MGR DOE SNF Disposal Container System*, ANL-EDC-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0141	Entire	N/A	Table 7	Classification of EDC as QL1	N/A	N/A	N/A	N/A
17	CRWMS M&O 1999g. *Classification of the MGR Waste Handling Building System*, ANL-HBS-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0184	Entire	N/A	Table 7	Classification of HBS as QL1	N/A	N/A	N/A	N/A
18	CRWMS M&O 1999h. *Classification of the MGR Non-Fuel Components Disposal Container System*, ANL-NDC-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0140	Entire	N/A	Table 7	Classification of NDC as QL1	N/A	N/A	N/A	N/A

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No.	Technical Product Input Source Title & Identifiers with Version	Section	Input Status	Section Used In	Input Description	TBV/ TBD Priority	Unqual.	From Uncontrolled Source	Unconfirmed
19	CRWMS M&O 1999i. *Classification of the MGR Uncanistered SNF Disposal Container System*, ANL-UDC-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0216	Entire	N/A	Table 7	Classification of UDC as QL1	N/A	N/A	N/A	N/A
20	CRWMS M&O 1999j. *Classification of the MGR Naval Spent Nuclear Fuel Disposal Container System*, ANL-VDC-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0218	Entire	N/A	Table 7	Classification of VDC as QL1	N/A	N/A	N/A	N/A
21	CRWMS M&O 1999k. *Classification of the MGR Waste Emplacement System*, ANL-WES-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990927.0477	Entire	TBV-460	Table 7	Classification of WES as QL1	1	X	N/A	N/A
22	CRWMS M&O 1999l. *Classification of the MGR Waste Retrieval System*, ANL-WRS-SE-000001 REV REV00. Las Vegas Nevada: CRWMS M&O. ACC: MOL.19990928.0213	Entire	N/A	Table 7	Classification of WRS as QL1	N/A	N/A	N/A	N/A
23	U.S. DOE 1997. *WIPP Safety Analysis Report* (SAR), DOE/WIPP 95-2065, Revision 2, December 1997 TIC: 235209	3.1.3.3.1	N/A	5.3	Tornado recurrence interval	N/A	N/A	N/A	N/A
24	U.S. DOE 1998. *Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program (QARD).* DOE/RW/0333P Rev. 08. Vienna, Virginia: CRWMS M&O. ACC: MOL.19980601.0022	Entire	N/A	2	General Reference	N/A	N/A	N/A	N/A

Document Identifier No./Rev.: ANL-MGR-SE-000001 REV 00			Change: N/A	Title: MGR Design Basis Extreme Wind/Tornado Analysis					
Input Document							TBV Due To		
No.	Technical Product Input Source Title & Identifiers with Version	Section	Input Status	Section Used In	Input Description	TBV/ TBD Priority	Unqual.	From Uncontrolled Source	Unconfirmed
24	Dyer, J. R. 1999. *Revised Interim Guidance Pending Issuance of New U.S. Nuclear Regulatory Commission (NRC) Regulations (Revision 01, July 22 1999) for Yucca Mountain, Nevada.* Letter from J. Russell Dyer (DOE) to D. R. Wilkins (YMP), September 03, 1999, with enclosure, *Interim Guidance Pending Issuance of New NRC Regulations for Yucca Mountain* (Revision 01), OL&RC: SB-1714. ACC: MOL.19990910.0079.	Entire	N/A	4.2.1 7.1	Required SAR content Definition of DBE & probability of events that must be considered	N/A	N/A	N/A	N/A
25	Regulatory Guide 1.76, *Design Basis Tornado For Nuclear Power Plants,* April 1974 Readily Available	Entire	N/A	6.2	NRC guidance for design basis tornado	N/A	N/A	N/A	N/A
26	Ramsdell and Andrews 1986. *Tornado Climatology of the Contiguous United States* NUREG/CR-4461, May 1986 Readily Available	Entire	N/A	6.2	Tornado data for the United States	N/A	N/A	N/A	N/A
27	NRC 1987. *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,* NUREG- 0800, June 1987 Readily Available	2.3.1 II 2.3.1 II 2.3.1 I 3.3.1 II 3.3.2 II 3.5.1.4 3.5.3	N/A	4.2.2 4.2.3 4.2.4 & 4.2.5 4.2.6 4.2.7 6.3 6.3	Criteria for Extreme Winds, Tornadoes and Tornado-Generated Missiles	NA	N/A	N/A	N/A

Attachment II

Acronyms

ACRONYMS

CFR	Code of Federal Regulations
CPB	Carrier Preparation Building
CRWMS	Civilian Radioactive Waste Management System
DBE	Design Basis Event
DOE	U.S. Department of Energy
M&O	Management and Operating Contractor
MGR	Monitored Geological Repository
NRC	Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
QL1	Quality Level-1
WHB	Waste Handling Building
WTB	Waste Treatment Building
YMP	Yucca Mountain Site Characterization Project