



RISK MANAGEMENT

NATURAL CATASTROPHE RISK SOLUTIONS

Providing Natural Hazards Risk and Extreme Loads Solutions Worldwide





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ABS Group Natural Catastrophe Services

ABS Group is a global provider of unbundled risk, safety and engineering solutions related to natural hazards, offering a broad range of services across many markets.

Our engineers have decades of experience performing natural hazards risk and vulnerability assessments, detailed design for new and existing structures and equipment installation mitigations.

Additionally, our team provides design reviews and financial loss evaluations for seismic, hurricane, typhoon, flood and other severe natural hazards events (PML/MFL/NLE).

ABS Group has more than 45 years of on-site experience in risk assessment and mitigation analyses for virtually every kind of facility including single-site locations, commercial buildings and complex chemical, petrochemical, manufacturing, beverage, utility, energy transmission and distribution operations.

Our risk and engineering experts support our client's needs for a wide spectrum of natural hazards, including:

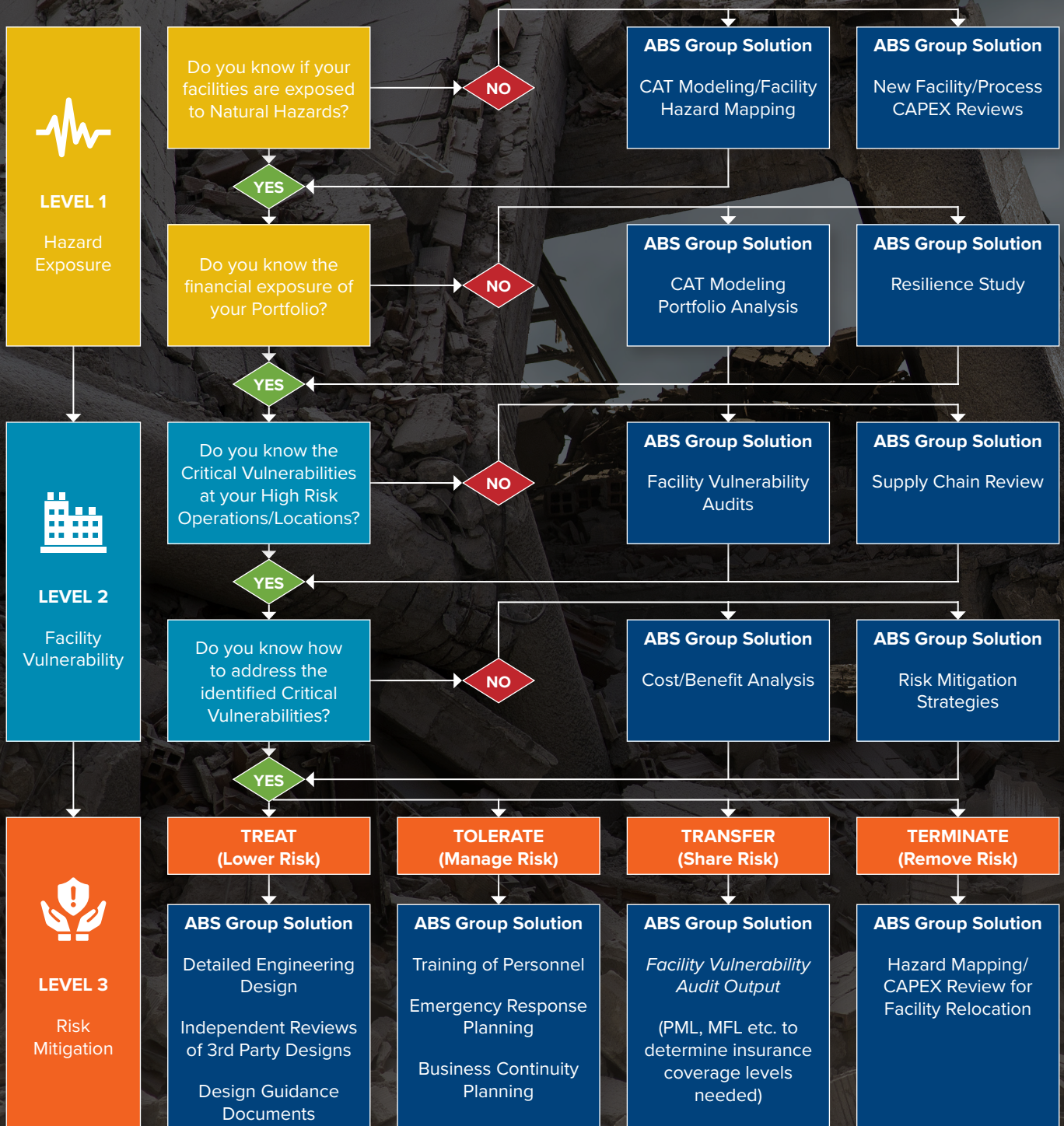
- Windstorm
- Tornado
- Flood
- Volcanism
- Hail
- Lightning
- Tsunami
- Earthquake

We support our clients from initial exposure assessments to the development and implementation of complete risk reduction programs that utilize our engineering expertise for detailed mitigation design and third-party independent technical reviews.



Natural Hazards Risk Reduction Program

ABS Group's Natural Hazards Risk team employs a phased approach in their risk reduction programs to support and guide clients in managing natural hazard risk. The approach begins with a review of hazard exposures that drive risk reduction programs from critical vulnerability identification and assessment to targeted risk treatment strategies, all devised to enhance operational resilience.



CAT Modeling

In terms of loss prevention, CAT Modeling Studies are the first steps to understanding the exposure and potential financial loss levels from natural hazards. They form the foundations for wider risk management strategies.

We utilize state-of-the-art CAT modeling platforms, which when combined with our 45 plus years of on-site vulnerability knowledge for extreme events, provides our clients with invaluable expertise and support in quantifying and managing natural hazards risk. From basic hazard mapping and establish exposure to complete CAT modeling portfolios we support our clients in fully quantifying exposures.

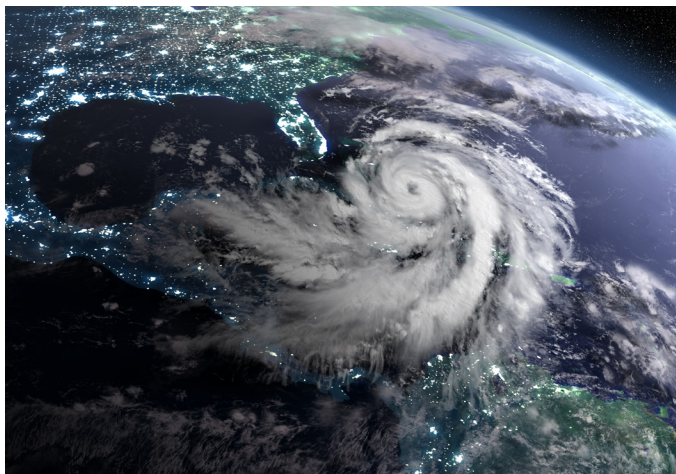


Figure 1 – Example output from CAT Modeling of a Global Portfolio

Hazard Mapping:

- Geocoding of Locations
- Mapping Against Natural Hazards
 - ☑ Single or Multiple Hazards Considered
 - ☑ Single or Multiple Return Periods Considered
- Location Categorizing by High, Moderate or Low Hazard
- Outline Guidance for the High Hazard Locations (Optional)
 - ☑ Applicable Design Loads
 - ☑ Design Codes and Standards Guidance

CAT Modeling:

- Hazard Mapping Outputs, plus the following elements are contained in the reporting:
- Vulnerability Descriptors
- Financial Loss Estimates (NLE, PML, MFL)
 - ☑ Property Damage (PD)
 - ☑ Business Interruption (BI)
 - ☑ Single Site and Aggregate Losses
- Risk Ranking to Identify High-Risk Assets
- High-Level Recommendations

FACILITY RANKING										EARTHQUAKE					
Rank	Country	Facility Name	Primary Occupancy	Buildings	Equipment	Stock	PD	BI (12 Months)	PD + BI (12 Months)	PML			MFL		
										Total PML (PD + BI) (€)	Total PML (%)	BI Period (Months)	Total MFL (PD + BI) (€)	Total MFL (%)	BI Period (Months)
1	Mexico	Location 1	Manufacturing Site	€ 82,716,772	€ 105,173,912	€ 26,665,665	€ 214,556,348	€ 209,467,280	€ 424,023,628	€ 202,188,029	47,68%	12	€ 307,581,003	72,54%	18
2	Japan	Location 22	Manufacturing Site	€ 93,798,400	€ 311,045,200	€ 71,587,911	€ 476,431,511	€ 101,883,163	€ 578,314,674	€ 158,329,244	27,38%	10	€ 344,252,385	59,53%	14
3	Philippines	Location 45	Manufacturing Site	€ 162,188,000	€ 305,416,000	€ 42,147,754	€ 509,751,754	€ 520,896,850	€ 1,030,648,604	€ 149,260,732	14,48%	10	€ 236,076,873	22,91%	13
4	Spain	Location 15	Manufacturing Site	€ 296,033,753	€ 868,695,891	€ 279,976,573	€ 1,444,706,217	€ 428,455,622	€ 1,873,161,839	€ 102,016,651	5,45%	5	€ 137,721,286	7,35%	8
5	Italy	Location 78	Manufacturing Site	€ 194,386,910	€ 507,723,775	€ 285,950,528	€ 988,061,213	€ 417,156,794	€ 1,405,218,007	€ 99,382,269	7,07%	4	€ 134,145,336	9,55%	6
6	USA	Location 162	Manufacturing Site	€ 99,655,380	€ 551,506,804	€ 87,448,614	€ 738,610,798	€ 260,682,047	€ 999,292,845	€ 70,028,650	7,01%	1	€ 91,752,154	9,18%	4
7	Spain	Location 7	Manufacturing Site	€ 51,039,600	€ 144,003,445	€ 64,994,612	€ 260,037,657	€ 69,709,810	€ 329,747,467	€ 60,656,022	18,39%	4	€ 72,274,324	21,92%	7
8	Malaysia	Location 80	Manufacturing Site	€ 169,646,429	€ 179,907,143	€ 9,343,034	€ 358,896,605	€ 328,973,216	€ 687,869,822	€ 45,897,610	6,67%	1	€ 73,312,045	10,66%	3
9	USA	Location 19	Distribution Centre	€ 78,501,200	€ 226,340,455	€ 75,225,013	€ 380,066,668	€ 67,759,300	€ 447,825,968	€ 36,149,577	8,07%	2	€ 41,796,185	9,33%	4
10	Chile	Location 55	Warehouse	€ 45,814,400	€ 87,730,542	€ 145,855,456	€ 279,400,398	€ 262,829	€ 279,663,227	€ 18,032,277	6,45%	< 1.0	€ 18,294,688	6,54%	2

Facility Vulnerability Audits

ABS Group's Natural Catastrophe (NatCat) Facility Vulnerability Audits have been developed over many decades to allow clients not only to understand their risk but to proactively manage it.

Audits can be managed remotely or onsite, with the scope based on individual client requirements. There are several key components to our audits and reports:

- Facility Specific Hazards Evaluation
- Vulnerability Evaluations
 - ☑ Buildings
 - ☑ Production Equipment
 - ☑ Utility Systems/Lifelines
 - ☑ Surrounding Infrastructure
 - ☑ Supply Chain/Stocks
- Personnel Safety/Human Elements
- Emergency Preparedness Reviews (ERP, BCP and more)
- Financial Loss Estimation (PML, MFL and more)
 - ☑ Pre and Post-Mitigation Estimates
 - ☑ Mitigation Cost Estimates
- Recommendations and Mitigation Options



Natural Hazards Engineering Services

ABS Group has a global team of risk engineers covering structural, mechanical, electrical, fire and process disciplines. This pool of experience allows us to provide specialized engineering services to support natural hazards risk management programs.

The support is provided at all stages of the process, from outline mitigation optioneering and detailed engineering design to implementation phase support. In addition, we regularly provide independent verification services in support of Capital Expenditure (CAPEX) programs.



Detailed Engineering Design

We provide a vast range of engineering services for mitigation design and performance assessments to address natural hazards risks for client operations, including:

- Basis of Design Documentation Production
- Concept and Feasibility Design Studies
- Structural Analysis and Retrofit of Buildings
- Production and Utility Equipment Mitigation
- Provision of Cost-Effective Mitigation Solutions
- Engineering Verification and Independent Review
- Site Supervision and Auditing

CAPEX Reviews

Our CAPEX reviews ensure that natural hazards risks are properly addressed and that no new risks are introduced to the operations. Support is provided through:

- Independent Technical Assessments
- Design Reviews
- Project Feasibility Studies
- Code and Regulatory Compliance
- Life Safety and Business Protection Issue Reviews



Emergency Preparedness

ABS Group works closely with our clients to understand not only their operations but their capability to respond to damaging natural hazards events.

Our engineers evaluate existing buildings as candidate shelters and when necessary, develop structural solutions in accordance with sheltering criteria such as International Code Council (ICC) 500 and FEMA P-361.

We also provide training to help our clients protect their people and to quickly start the recovery process towards resuming normal operations.

We conduct a variety of evaluations and assessments to reduce risk and promote business continuity in the event of a natural hazards event, including:

- Emergency Preparedness and Business Recovery Planning
- Post Event Damage and Integrity Assessments
- Evaluation/Strengthening of Emergency Shelters
- Disaster and Evacuation Planning
- Training and Exercises
- Supply Chain Reviews
- Transportation Studies

Our Natural Hazards Risk team has extensive knowledge of building codes, state-of-the-art design tools, evaluation methodologies and in-depth experience in conducting investigations around the world to help you manage natural hazards risk.

Supply Chain Analysis

The complexities of modern global supply chains can leave organizations exposed to major natural hazards events, resulting in disruptive shocks. Even an event thousands of miles away can have an enormous impact on business operations, affecting owned facilities or key partners.

Physical assets such as factories, warehouses, shipping terminals and stores are vulnerable to the loss of critical resources such as property, power and transportation, particularly in today's complex business environment.

ABS Group supports our clients globally by identifying, quantifying and designing solutions to minimize event consequences and get our clients back online quickly. We support our clients by performing:

Supply Chain Mapping – Gauging up and downstream flows of materials, goods and related intercompany operations to identify locations exposed to natural hazards.

Bottleneck Identification – Reviewing the supply chain system to identify critical points which could generate greater consequences, such as single-source suppliers or critical transportation hubs.

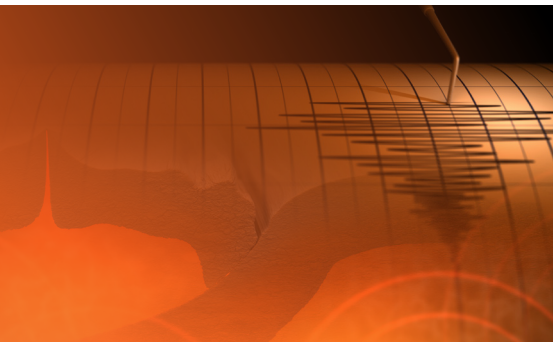
Review of Supply Chain Design – Reviewing the supply chain for elements such as single sourcing, just-in-time, inventory optimization methods and outsourcing usage.

Supply Chain Exposure/Vulnerability – Understanding the amount of time a facility or transportation route/hub could be affected by a natural hazards event.

Recovery Time Review – Understanding the amount of time it will take to bring operations back online or get alternate locations up and running, and how long your supply chain will survive without this output.

Supply Chain Strategies – Understanding how you can adapt operations to reduce disruption (e.g., Inventory Management, Transportation Alternatives, Supplier Management, Operational Standardization and Business Continuity Planning).





About ABS Group

ABS Group of Companies, Inc. (www.abs-group.com), through its operating subsidiaries, provides data-driven risk and reliability solutions and technical services that help clients confirm the safety, integrity, quality and environmental efficiency of critical assets and operations. Headquartered in Spring, Texas, ABS Group operates with more than 1,000 professionals in over 20 countries serving the marine and offshore, oil, gas and chemical, government and industrial sectors. ABS Group is a subsidiary of ABS (www.eagle.org), one of the world's leading marine and offshore classification societies.

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