

# **IAEA SAFETY STANDARDS**

Unregistered version, please register [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

## ***External Human Induced Events in Site Evaluation for NPPs, NS-G-3.1***

**Regional Workshop on Volcanic, Seismic, and Tsunami Hazard  
Assessment Related to NPP Siting Activities and Requirements  
June 13-17, Jakarta, Indonesia**

**Ayhan Altinyollar  
Department of Nuclear Safety and Security**

**INTERNATIONAL SEISMIC SAFETY CENTRE, NSN/IAEA**



**IAEA**

International Atomic Energy Agency



# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

## IAEA Safety Standards Series No. NS-R-3, Site Evaluation for Nuclear Installations:

2.1 .... In the evaluation of the suitability of a site for a nuclear installation, the following aspects shall be considered:

(a) The effects of external events occurring in the region of the particular site (these events could be of natural origin or **human induced**).

2.5 Proposed sites for nuclear installations shall be examined with regard to the **frequency and severity** of external natural and **human induced events** and phenomena that could affect the safety of the installation.



# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

2.14. Proposed sites shall be adequately investigated with regard to all the site characteristics that could be significant to safety in external natural and **human induced events**.

2.15. Possible natural phenomena and **human induced situations and activities** in the region of a proposed site shall be **identified and evaluated** according to their significance for the safe operation of the nuclear installation. This evaluation should be used to identify the important natural phenomena or **human induced situations and activities** in association with which potential hazards are to be investigated.



# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

2.16. Foreseeable significant changes in land use shall be considered, **such as the expansion of existing installations and human activities or the construction of high risk installations.**

2.19. The size of the region to which a method for establishing the hazards associated with major external phenomena is to be applied shall be **large enough** to include all the features and areas that could be of significance in the determination of the natural and **human induced phenomena** under consideration and for the characteristics of the event.



# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

2.20. Major natural and human induced phenomena shall be expressed in terms that can be used as input for deriving the hazards associated with the nuclear installation; that is, appropriate parameters for describing the hazard should be selected or developed.



# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

3.44. The potential for aircraft crashes on the site shall be assessed with account taken, to the extent practicable, of characteristics of future air traffic and aircraft.

3.45. If the assessment shows that there is a potential for an aircraft crash on the site that could affect the safety of the installation, then an assessment of the hazards shall be made.

3.46. The hazards associated with an aircraft crash to be considered shall include impact, fire and explosions.

3.47. If the assessment indicates that the hazards are unacceptable and if no practicable solutions are available, then the site shall be deemed unsuitable.



# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

3.48. Activities in the region that involve the **handling, processing, transport and storage of chemicals** having a potential for explosions or for the production of gas clouds capable of deflagration or detonation **shall be identified**.

3.49. **Hazards associated with chemical explosions** shall be expressed in terms of **overpressure and toxicity** (if applicable), with account taken of the effect of distance.

3.50. **A site shall be considered unsuitable** if such activities take place in its vicinity and **there are no practicable solutions available**.



# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

3.51. The region shall be investigated for installations (including installations within the site boundary) in which **flammable, explosive, asphyxiant, toxic, corrosive or radioactive materials** are stored, processed, transported and otherwise dealt with that, if released under normal or accident conditions, could jeopardize the safety of the installation. This investigation shall also include installations that may give rise to **missiles of any type** that could affect the safety of the nuclear installation. The potential effects of electromagnetic interference, eddy currents in the ground and the clogging of air or water inlets by debris shall also be evaluated. If the effects of such phenomena and occurrences would produce an unacceptable hazard and if no practicable solution is available, **the site shall be deemed unsuitable.**





# Background

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

5.1. The characteristics of the natural and **human induced hazards** as well as the demographic, meteorological and hydrological conditions of relevance to the nuclear installation **shall be monitored over the lifetime of the nuclear installation.**



# IAEA SAFETY STANDARDS SERIES

External Human Induced  
Events in Site Evaluation  
for Nuclear Power Plants

## SAFETY GUIDE

No. NS-G-3.1



INTERNATIONAL  
ATOMIC ENERGY AGENCY  
VIENNA



# Introduction

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- **Facilities and human activities** in the region in which a nuclear power plant is located may under some conditions affect its safety.
- The **potential sources of human induced events** external to the plant should be **identified** and the severity of the possible resulting hazard phenomena should be **evaluated to derive the appropriate design bases for the plant**.
- They should also be **monitored** and **periodically assessed** over the lifetime of the plant to ensure that consistency with the design assumptions is maintained.



# Introduction

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- This safety guide is the first revision of the Safety Guide on External Man-Induced Events in Relation to Nuclear Power Plant Siting issued in 1981 as **Safety Series No. 50-SG-S5**.



# Objective

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- The objective of this Safety Guide is to provide recommendation and guidance for the examination of the region considered for site evaluation for a plant in order **to identify hazardous phenomena associated with human induced events initiated by sources external to the plant.**



# Scope

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- The external human induced events are all of **accidental origin**.
- Physical protection of the plant **against wilful actions** by third parties are **outside** its scope.
- It provides guidance for the **definition of hazards** for the site and on the general identification of major effects on the plant which are to be used in a design assessment framework.



# Table of contents

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- Introduction
- General approach of site assessment in relation to external human induced events
- Data collection and investigations
- Screening and assessment procedures
- Aircraft crashes
- Release of hazardous fluids
- Explosions
- Other external human induced events .
- Administrative aspects



# General Approach to site Evaluation

- External human induced events that could affect safety should be investigated in the **site evaluation stage** for every nuclear power plant site.
- The **region** is required to be examined for **facilities and human activities** that have the potential, under certain conditions, to endanger the nuclear power plant over its **entire lifetime**.
- Each relevant **potential source** is required to be **identified** and **assessed** to determine the potential interactions with personnel and plant items important to safety .



- Type of potential source
- Identification of potential sources
- Collection of information
- Stationary sources
- Mobile sources
- Source display map



# Type of Potential Sources

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- The sources of external human induced events may be classified as:
  - **Stationary sources** :
    - location of the initiating mechanism (explosion centre, point of release of explosive or toxic gases) **fixed** (chemical plants, oil refineries, storage depots and other nuclear facilities at the same site).
  - **Mobile sources** :
    - location of the initiating mechanism not totally constrained, such as any means of transport for hazardous materials or potential projectiles (by road, rail, waterways, air, pipelines). In such cases, an accidental explosion or a release of hazardous material **may occur anywhere** along a road or other way or pipeline.



# Identification of Potential Sources

- Installations which **handle, process or store** potentially hazardous materials such as explosive, flammable, corrosive, toxic or radioactive materials should be identified.
- **Pipelines** for hazardous materials ,
- Construction yards, mines and quarries which use and store explosives,
- Study on **airports** and their takeoff, landing and holding patterns, flight frequencies and types of aircraft.
- **Conveyance** of hazardous materials by sea or inland waterways.



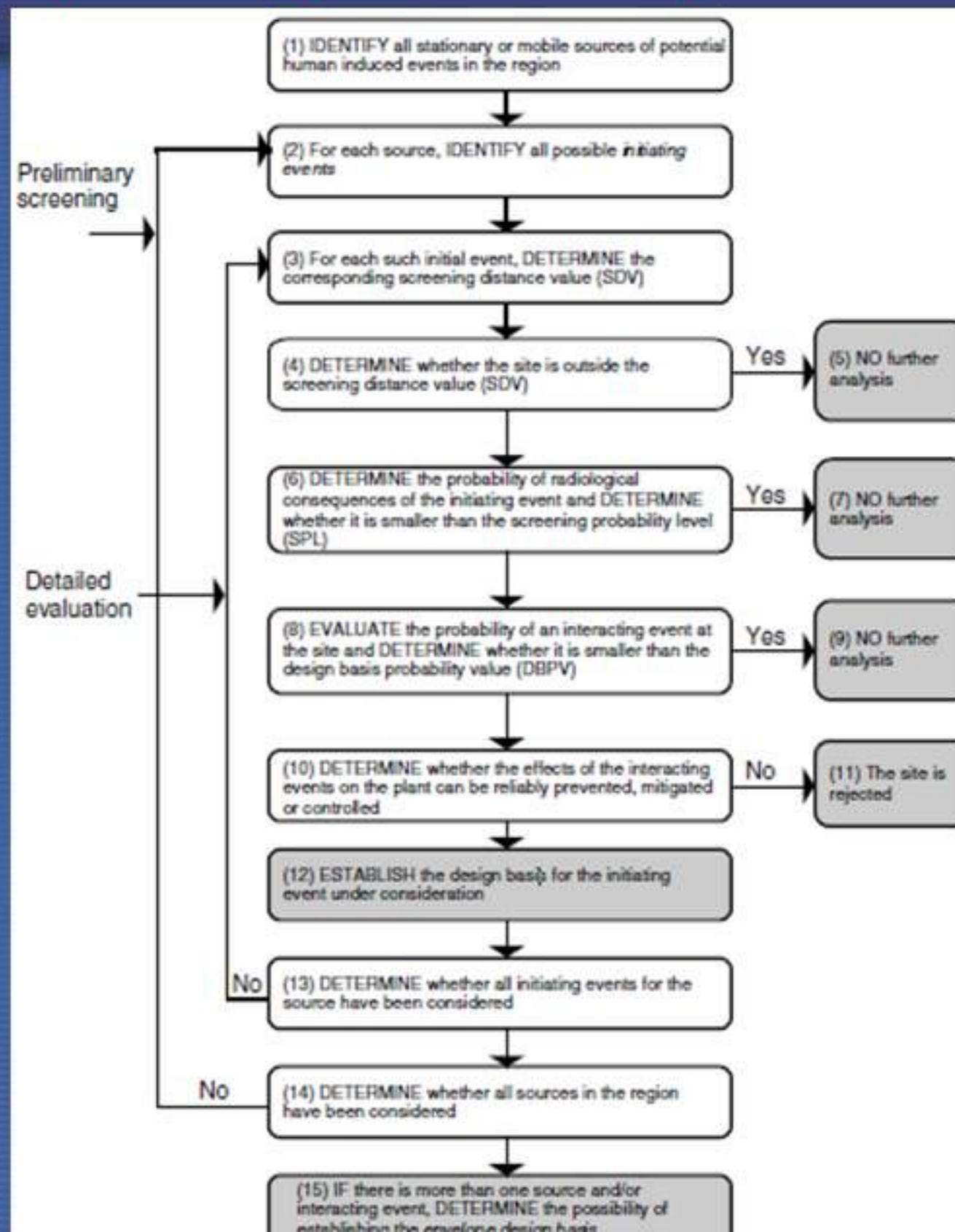
# Screening and evaluation procedures

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- General procedure
  - ↳ Preliminary screening
  - ↳ Detailed evaluation
  - ↳ Design basis events and parameters



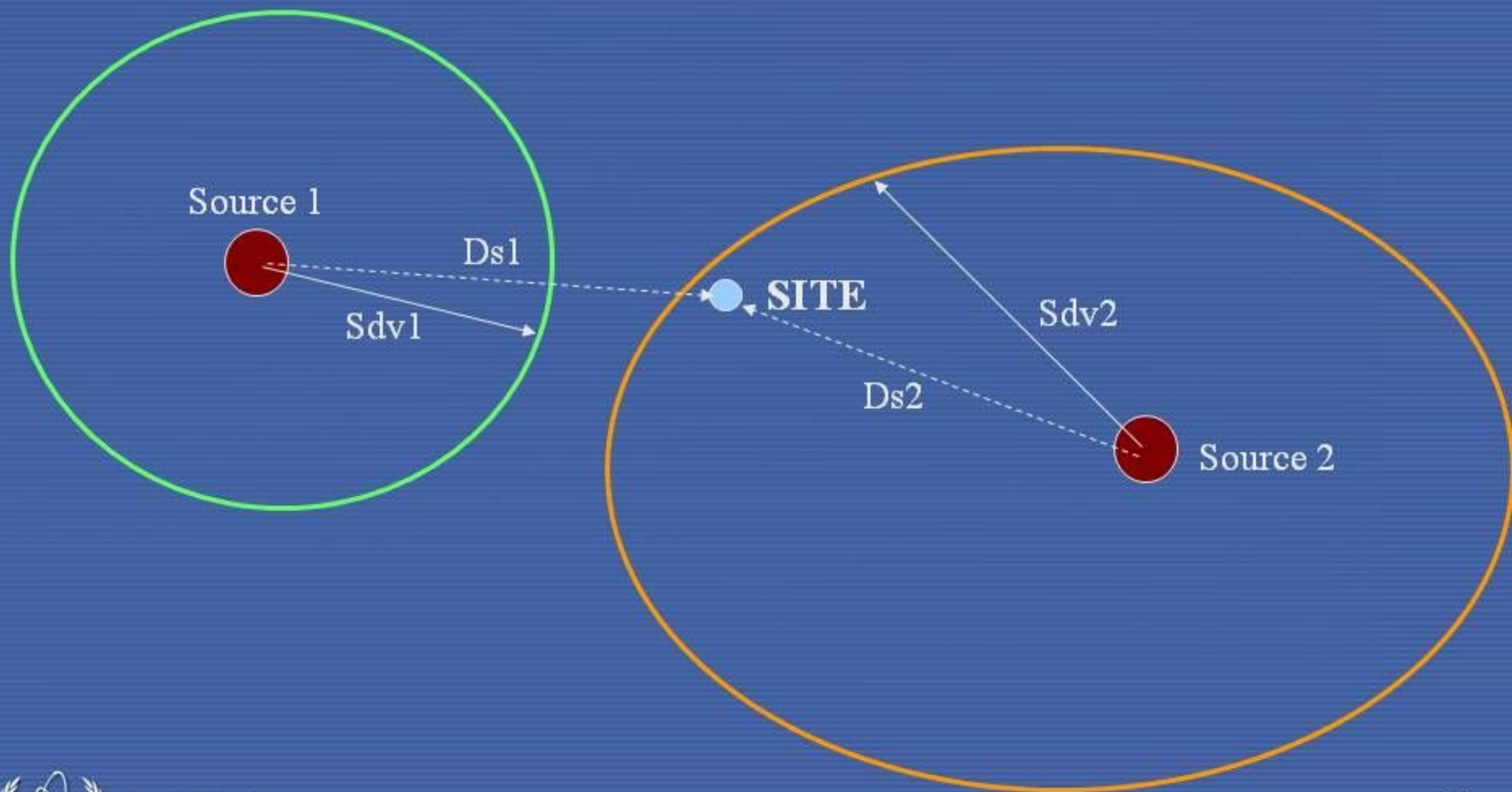
# Screening and evaluation procedures





# Screening Distance Value - SDV

Unregistered version, please register. [www.word-pdf-converter.com](http://www.word-pdf-converter.com)





# Detailed evaluation

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- If the probability of occurrence of the initiating event under consideration is greater than the specified SPL (Screening Probability Level) value, a detailed evaluation should be made. *This implies that the associated interacting events should be determined as well as their corresponding probabilities of occurrence.*
- An upper bound should be established denoted as the Conditional Probability Value (CPV) that this event will cause unacceptable radiological consequences.
- A Design Basis Probability Value (DBPV) for the interacting event under consideration should then be determined by dividing the SPL by the CPV.
  - If probability of interacting event is less than DBPV, no further consideration should be given to that event
  - If probability is greater than DBPV, it should be evaluated to establish whether or not the effects of the interacting event on the plant can be reliably limited by preventing or mitigating them or by taking engineering or administrative measures



# Design basis and parameters

Unregistered version, please register. [www.word-pdf-convert.com](http://www.word-pdf-convert.com)

- In the event that a probabilistic approach is applied to hazard evaluation, the design basis parameters for a particular interacting event should be those corresponding to a probability of occurrence equal to the DBPV.
- For two or more external human induced interacting events of a given type whose probabilities are similar (to within about an order of magnitude) and for which the plant should be protected, the design basis event should be based on the event having the most severe radiological consequences.
- Events within the following categories are discussed in greater detail in the subsequent sections because of their relevance to many possible nuclear power plant sites:
  - aircraft crashes;
  - chemical explosions (detonation and deflagration);
  - moving fluids and drifting clouds of explosive, flammable, corrosive, toxic, asphyxiant or radioactive material.
- Certain other events specific to a particular site should also be considered, for which a similar methodology should be adopted.









# International Atomic Energy Agency

Unregistered version, please register. [www.word-pdf-converter.com](http://www.word-pdf-converter.com)



***Thank you for your attention***