Pemilihan Tapak PLTN

Kurnia Anzhar

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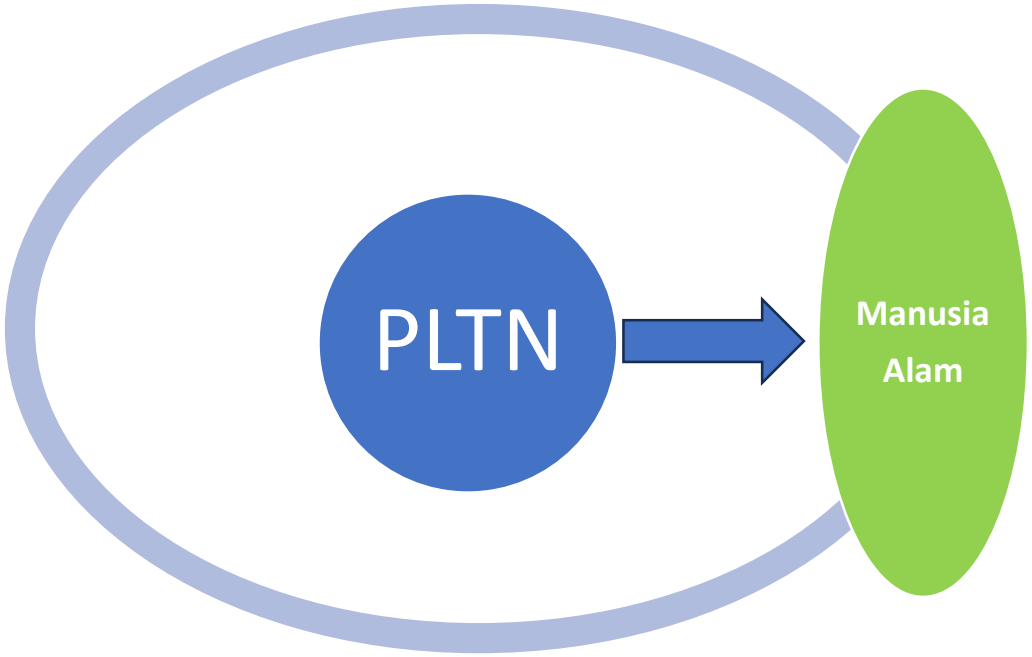
Daftar Isi

Daftar Isi

PENDAHULUAN

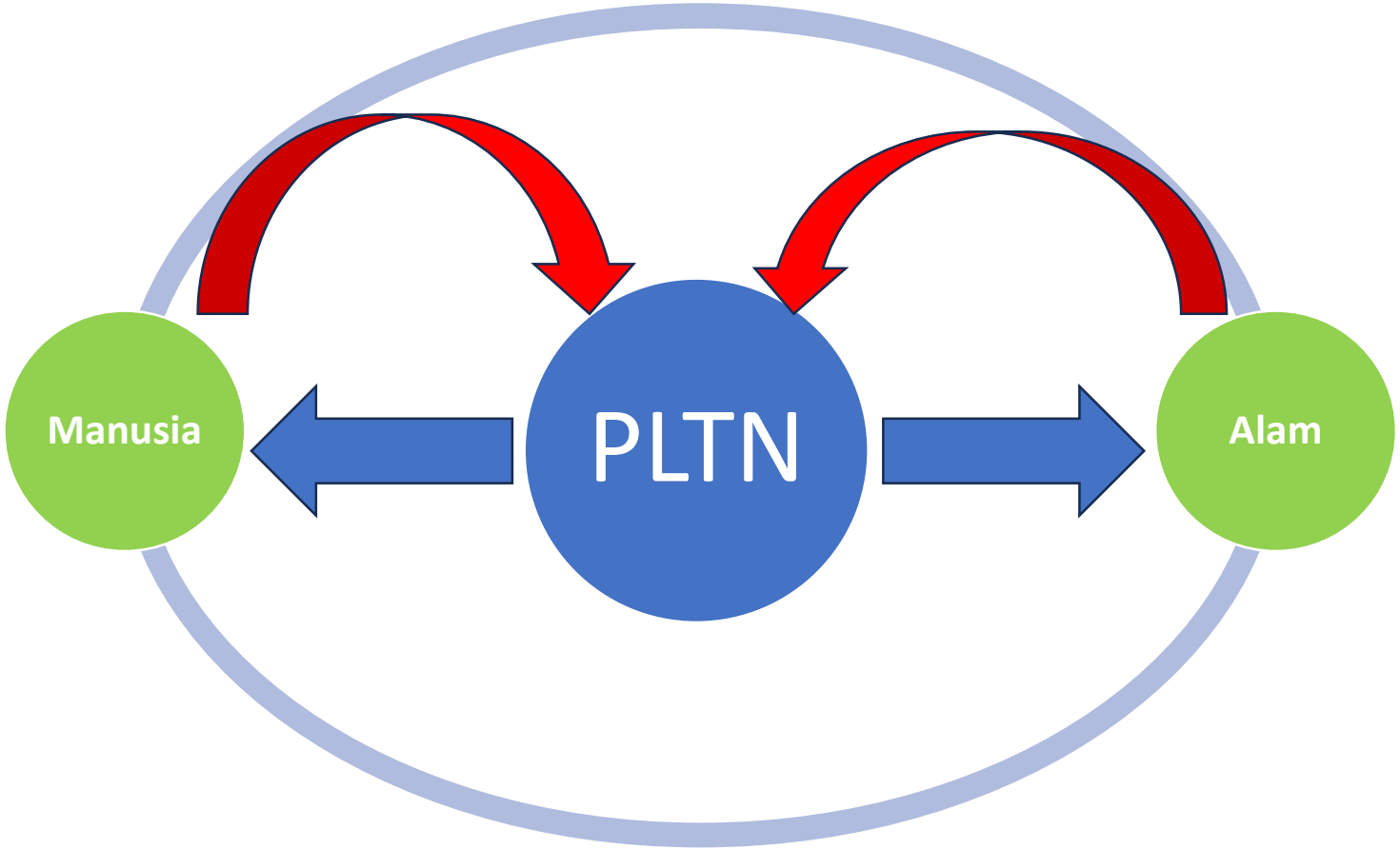
Latar Belakang



Melindungi manusia dan lingkungan dari dampak lepasan radiasi baik pada kondisi normal operasi PLTN maupun oleh akibat kecelakaan

PENDAHULUAN

Tujuan



Evaluasi Tapak

adalah kegiatan **analisis** atas setiap sumber kejadian di tapak dan wilayah sekitarnya yang dapat berpengaruh terhadap keselamatan Instalasi Nuklir.

Per. BAPETEN No. 4 / 2018

Daftar Isi

Kerangka Regulasi Instalasi Nuklir

UUD 1945

UU

Peraturan Pemerintah

Peraturan Badan

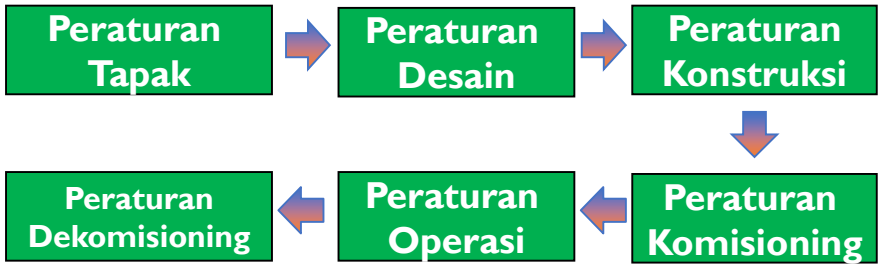
Undang-undang (UU) Nomor 6 Tahun 2023 tentang Penetapan Peraturan Pemerintah Pengganti Undang-Undang Nomor 2 Tahun 2022 tentang Cipta Kerja menjadi Undang-Undang

UU No.10/1997 Ketenaganukliran

PP No 2/2014 Perizinan Instalasi Nuklir dan Pemanfaatan Bahan Nuklir

PP No 5/2021 Penyelenggaraan Perizinan Berusaha Berbasis Risiko

PP No. 54 / 2012 on Keselamatan dan Keamanan Instalasi Nuklir



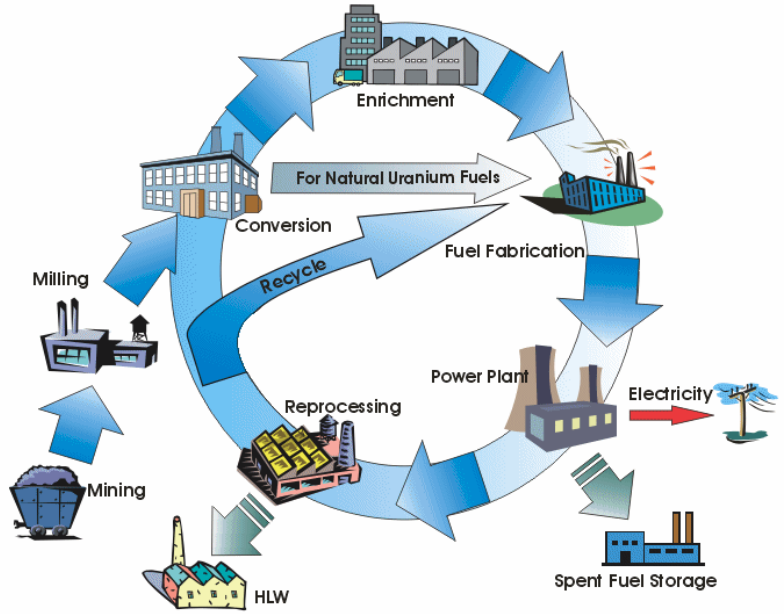
Perba 3/2021 Standar Kegiatan Usaha Dan Standar Produk Pada Penyelenggaraan Perizinan Berusaha Berbasis Risiko Sektor Ketenaganukliran

Perba 1/2022 Penatalaksanaan Perizinan Berusaha Berbasis Risiko Sektor Ketenaganukliran

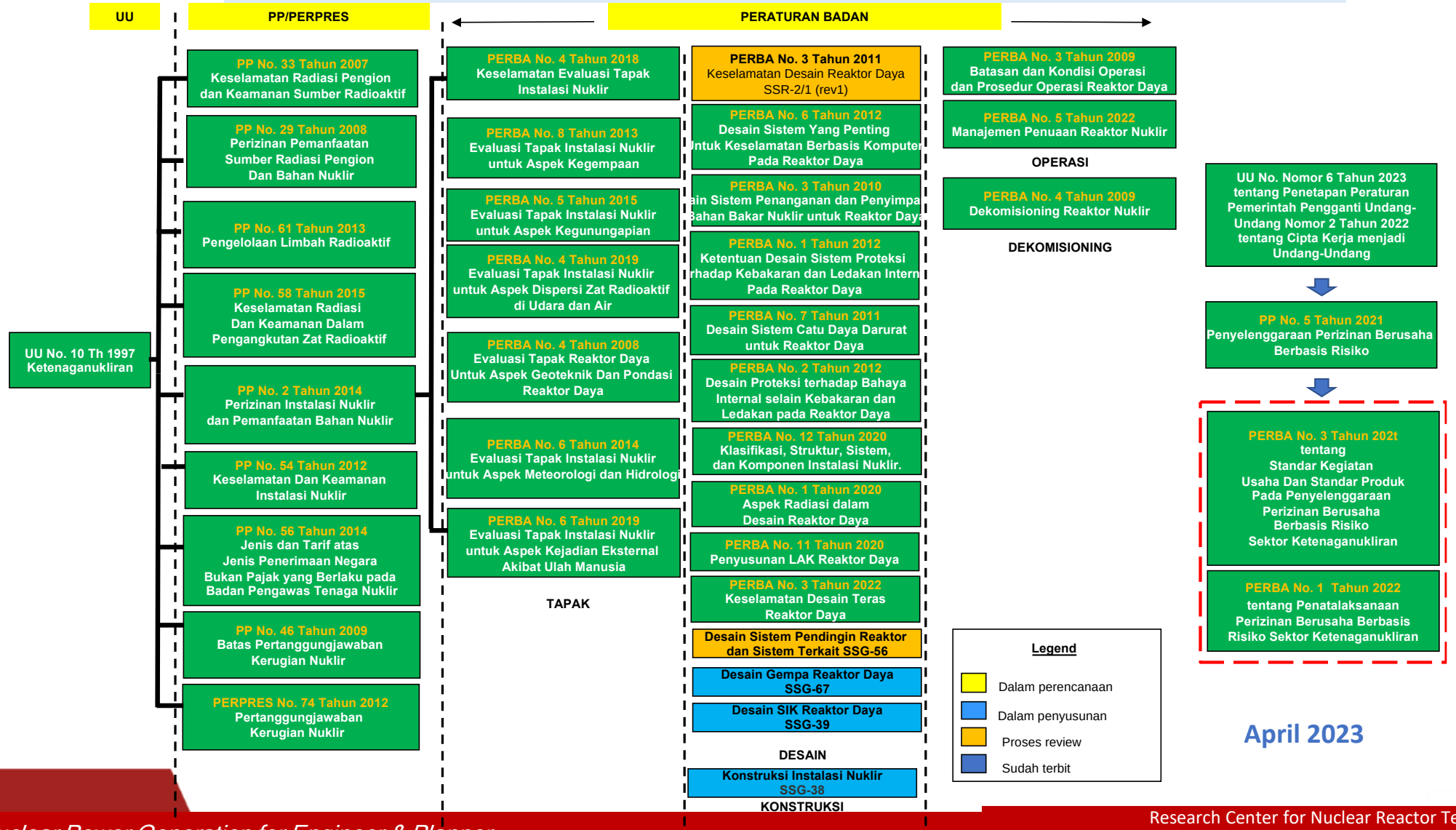
UU 10/1997 Ketenaganukliran

Instalasi Nuklir

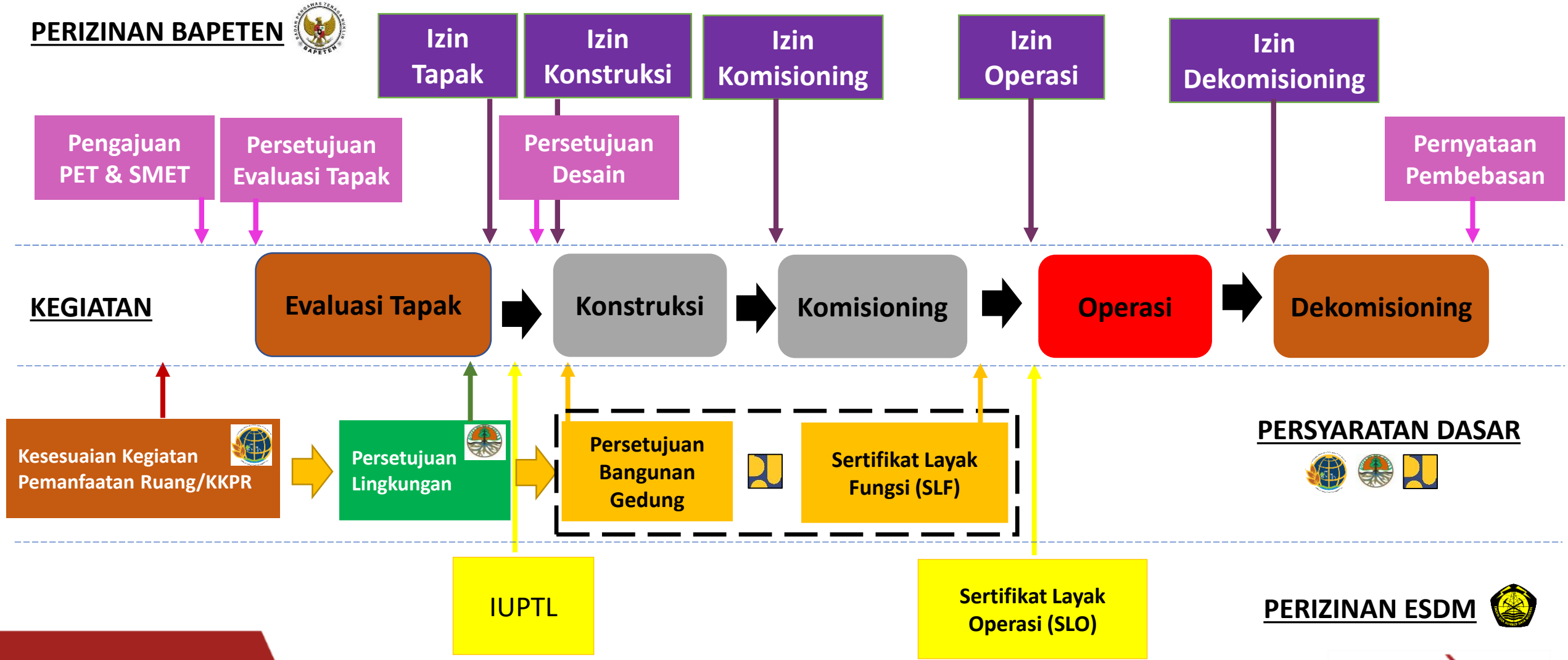
- **Reaktor Nuklir**
  - Pembangkitan daya → **Reaktor Daya (PLTN)**
  - Penelitian
  - Produksi radioisotop
  - Penelitian + Produksi radioisotop → Reaktor Non-daya
- Fasilitas untuk pemurnian, konversi, pengayaan bahan nuklir, fabrikasi bahan bakar nuklir dan/atau pengolahan ulang bahan bakar nuklir bekas
- Fasilitas untuk menyimpan bahan bakar nuklir dan bahan bakar nuklir bekas



Kerangka Regulasi – Reaktor Daya



PP 2/2014 dan PP 5/2021



Daftar Isi

PEMILIHAN TAPAK PLTN DI INDONESIA

- Site study activities in Indonesia: Muria Peninsula, Banten, Kalimantan Timur, Kalimantan Barat, Batam and Bangka
- NPP site study of Bangka (2011-2013), the result:
  - The sites are feasible based on topographical, geological, seismological, geotechnical, volcanological, hydrological, meteorological aspects
  - The sites are able to accommodate 10 unit NPP (@1.000-1.400 Mwe)

EVALUASI TAPAK

1. Persetujuan Evaluasi Tapak

- Program Evaluasi Tapak
- Sistem Manajemen Evaluasi Tapak

Perba No. 8/2018 – Pasal 4

2. Evaluasi Tapak

- Kegempaan;
- Kegunungapian;
- Geoteknik;
- Meteorologi dan Hidrologi;
- Ulah Manusia; dan
- Dispersi Zat Radioaktif

Perba No. 8/2018 – Pasal 9

- mengkaji **kelayakan tapak**; dan
- menentukan **nilai parameter dasar desain**

Perba No. 8/2018 – Pasal 7

3. Ijin Tapak

- Laporan Pelaksanaan Evaluasi Tapak
- Laporan Pelaksanaan Sistem Manajemen Evaluasi Tapak

Perba No. 8/2018 – Pasal 54

EVALUASI TAPAK

- Permohonan Persetujuan Evaluasi Tapak
  a. Program Evaluasi Tapak; dan
  b. Sistem Manajemen Evaluasi Tapak.
- Permohonan Izin Tapak
  a. Persyaratan administratif:
     - ✓ kesesuaian kegiatan pemanfaatan ruang
     - ✓ bukti hak atas tanah.
  b. Persyaratan teknis:
     - ✓ laporan pelaksanaan Evaluasi Tapak;
     - ✓ laporan pelaksanaan sistem manajemen Evaluasi Tapak;
     - ✓ Daftar Informasi Desain (DID); dan
     - ✓ dokumen yang memuat data utama Reaktor Nuklir.

Perba No. 8/2018 – Pasal 4

EVALUASI TAPAK

Lingkup Kegiatan Evaluasi Tapak

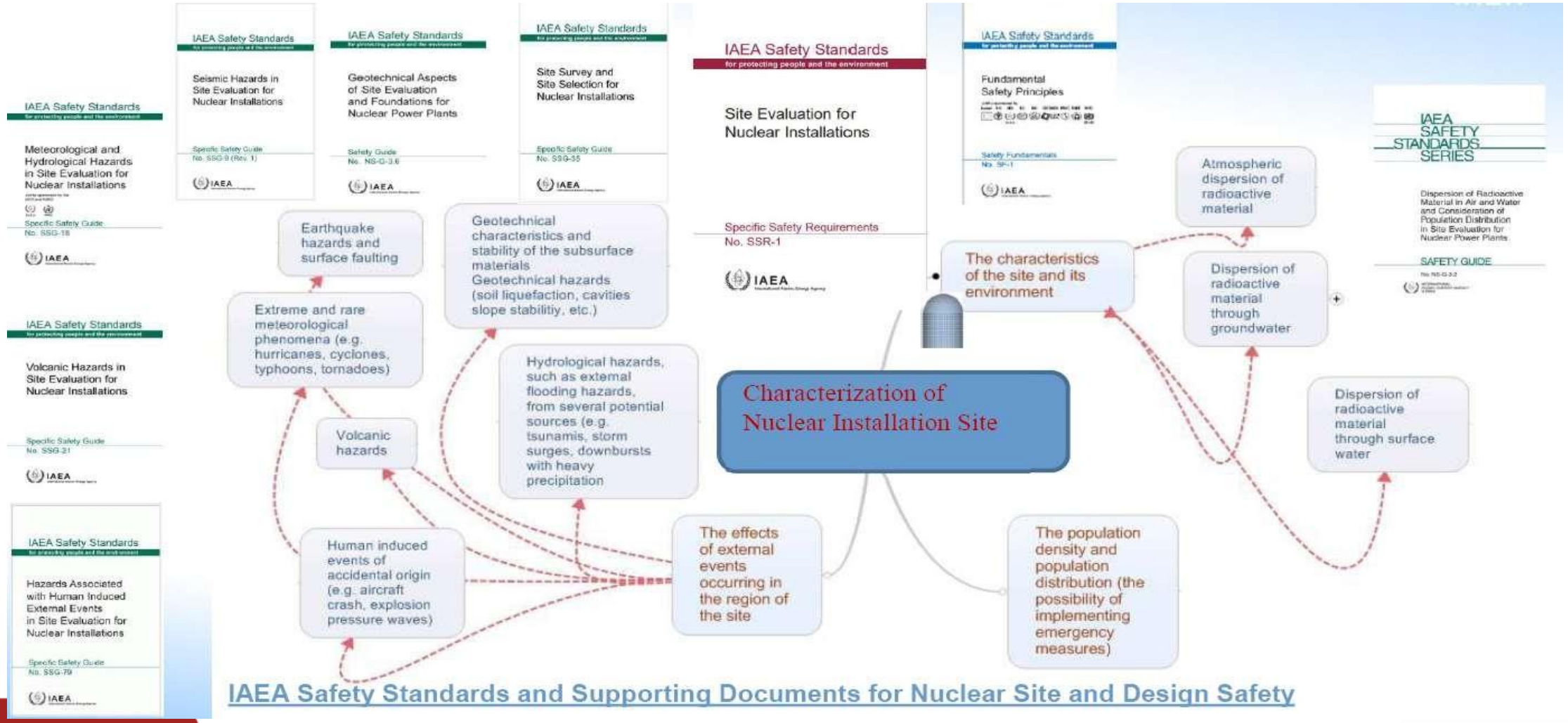
(ex: aspek kegempaan)

- Pengumpulan data dan Informasi
- Pembuatan Model
- Evaluasi Bahaya

Perba No. 8/2018 – Pasal 11

EVALUASI TAPAK

- **Karakterisasi Tapak**



EVALUASI TAPAK

Bahaya External

Human-Induced

- Aircraft crash
  - Shock effects
  - Potential penetration
  - Potential fire
- Explosions
- Collisions
- Releases of harmful materials
- External fires
- Correlated hazard combinations

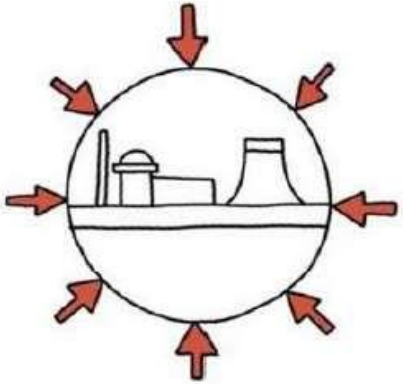
Natural Phenomena

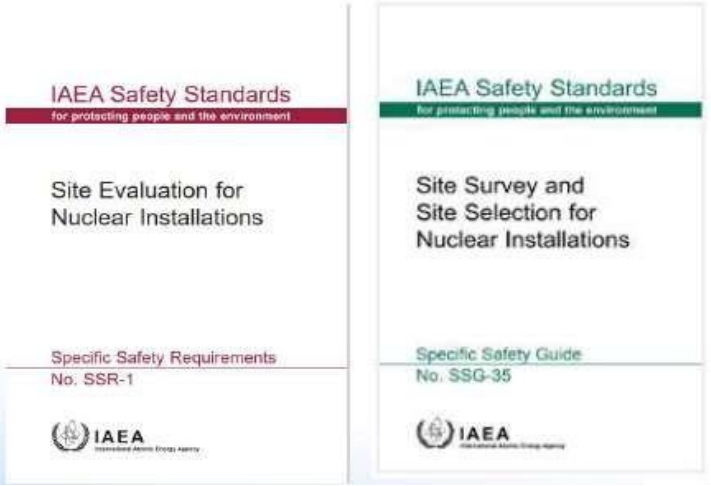
- Earthquakes
  - Vibratory ground motions
  - Non-vibratory ground motions
- External floods
  - Rain-induced, e.g., riverine flooding
  - Wind-induced, e.g., storm surge
  - Earthquake-induced, e.g., tsunami
  - Other, e.g., upstream dam failure
- Extreme wind
  - Pressure effects from straight wind, tropical storms, and tornadoes
  - Windborne missiles
- Extreme temperatures
- Correlated hazards (e.g., earthquake + tsunami)

EVALUASI TAPAK

Bahaya Eksternal

Human induced external hazards





Natural external hazards

EVALUASI TAPAK

Bahaya External – Aspek KAUM

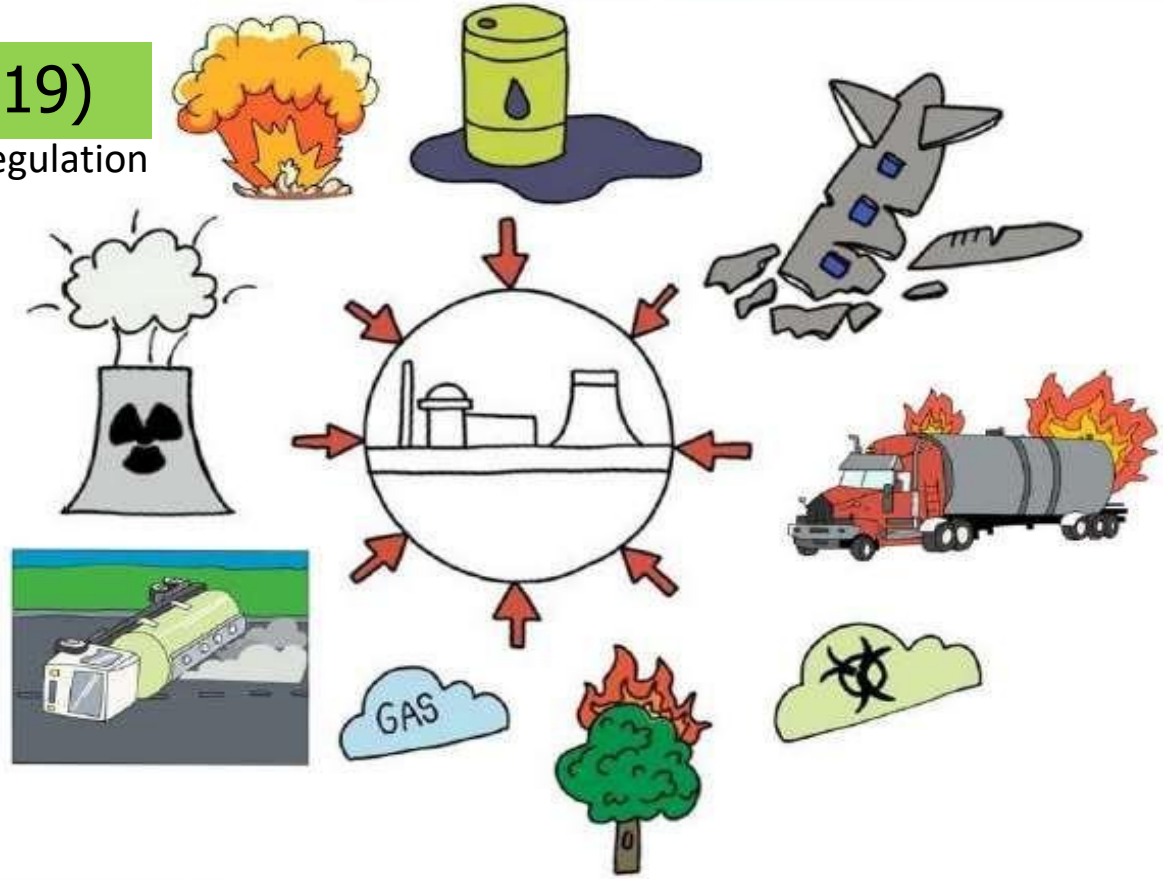
Human Induced Events (BCR* No. 6/2019)

*BAPETEN Chairman Regulation

- Human induced hazards
  - Fire
  - Explosions
  - Releases of hazardous gases from a nearby facility
  - Effects of hazardous materials
  - Aircraft crashes
  - Biological hazards

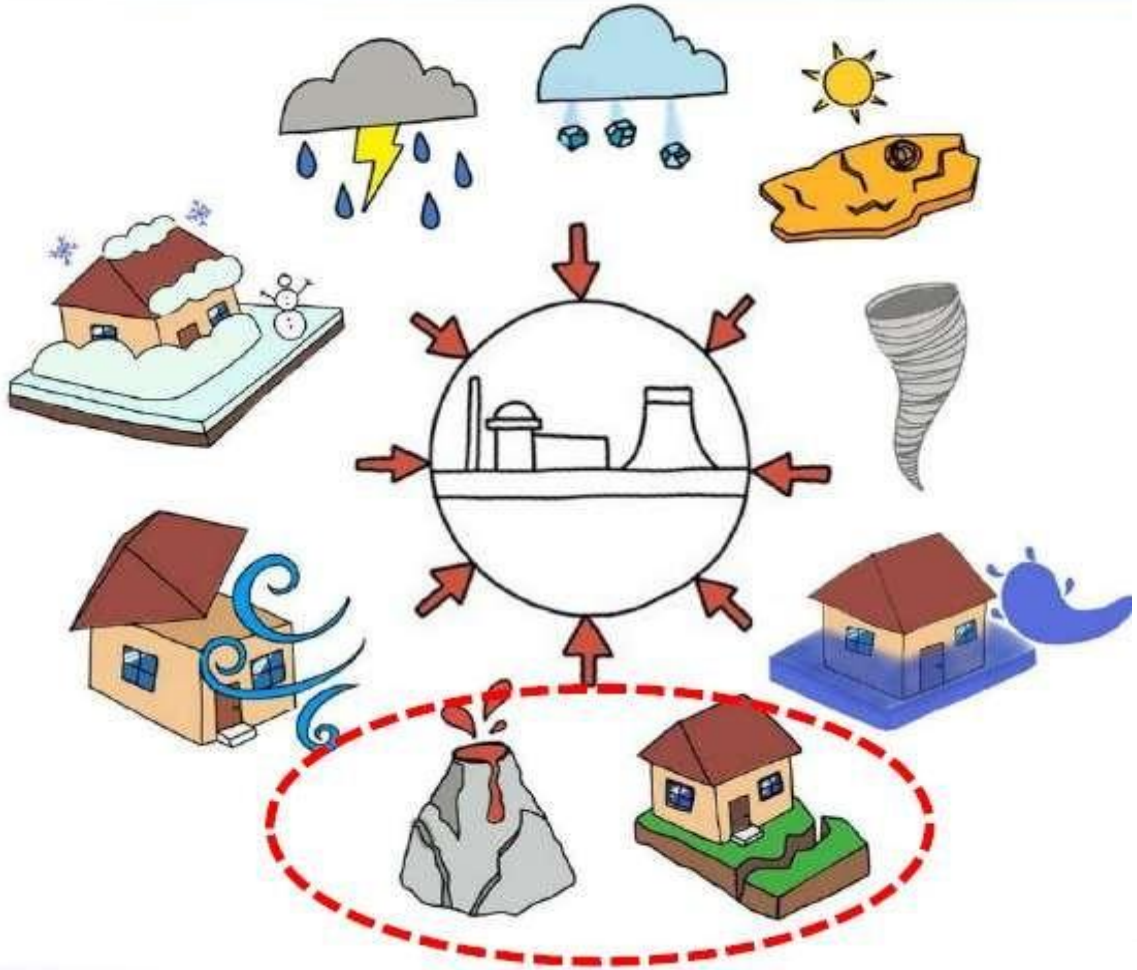
IAEA Safety Standards SSG-79 (e-book)

- Online User Interface



Bahaya External Alami – Aspek Geologi

- Natural hazards
  - Geological hazards
    - **Seismic hazards**
    - **Volcanic hazards**
    - **Geotechnical hazards**
  - Meteorological hazards
  - Hydrological hazards



Seismic (BCR No. 8/2013);
Volcanics (BCR No. 5/2015);
Geotechnics (BCR No. 4/2008);

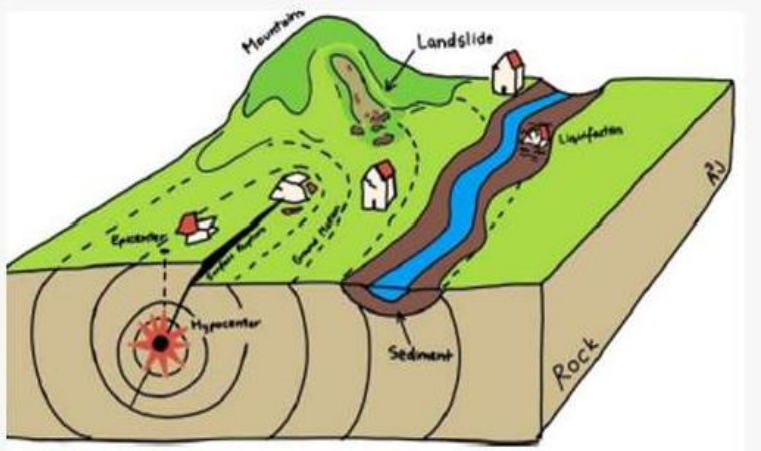
Bahaya External Alami – Aspek Kegempaan

SSR*-1 R15. Evaluation of fault capability

Geological faults larger than a certain size and within a certain distance of the site and that are significant to safety shall be evaluated to identify whether these faults are to be considered capable faults. For capable faults, potential challenges to the safety of the nuclear installation in terms of ground motion and/or fault displacement hazards shall be evaluated.

SSR-1 R16. Evaluation of ground motion hazards

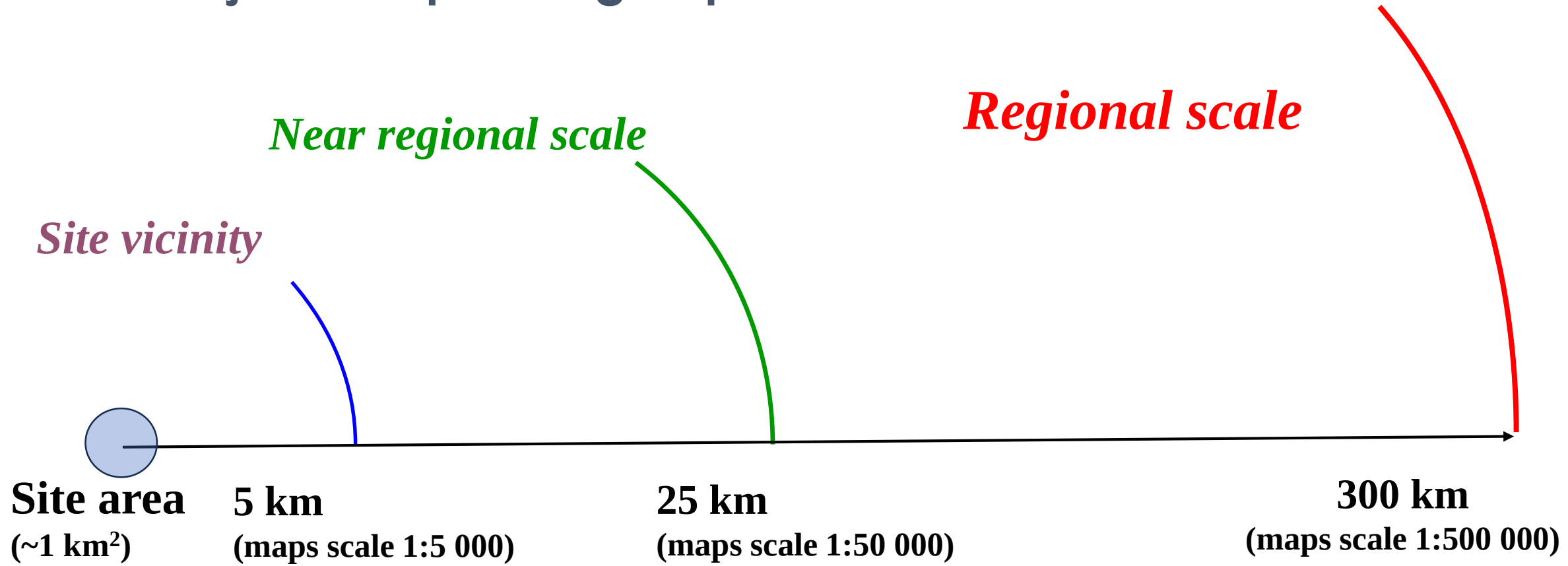
An evaluation of ground motion hazards shall be conducted to provide the input needed for the seismic design or safety upgrading of the structures, systems and components of the nuclear installation, as well as the input for performing the deterministic and/or probabilistic safety analyses necessary during the lifetime of the nuclear installation.



Drawn by J&A Aszódi, 2022, CC BY-SA 4.0
(Drawn with inspiration from Zhenming Wang et al, 2017)

**Specific Safety Requirement*

Area Kajian – Aspek Kegempaan



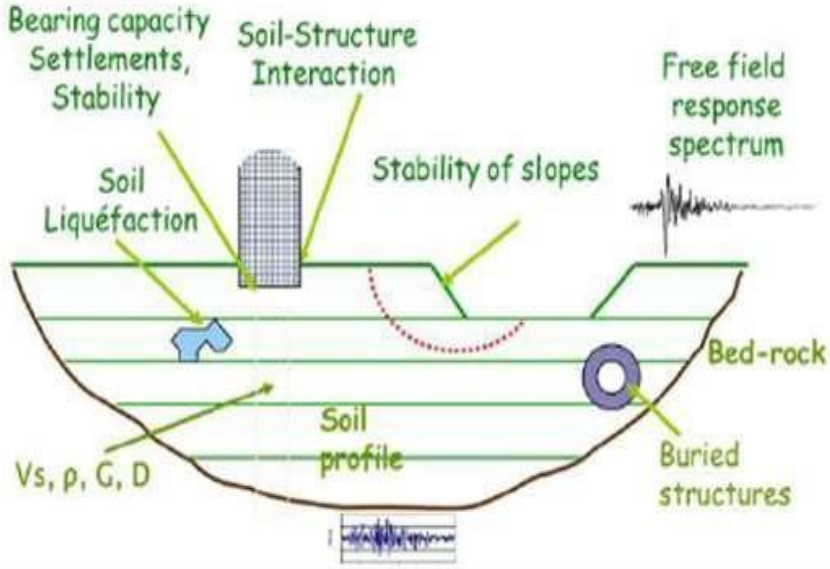
Bahaya External Alami – Aspek Geoteknik

SSR-1 R21. Geotechnical characteristics and geological features of subsurface materials

shall be investigated, and a soil and rock profile for the site that considers the variability and uncertainty in subsurface materials shall be derived.

SSR-1 R22. Geotechnical hazards and geological hazards, including slope instability, collapse, subsidence or uplift, and soil liquefaction, and their effect on the safety of the nuclear installation, shall be evaluated.

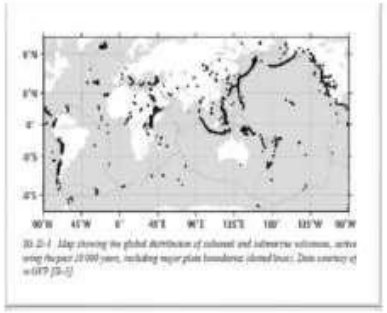
- Slope instability
- Collapse, subsidence or uplift of the site surface
- Soil liquefaction



Bahaya External Alami – Aspek Kegunungapian

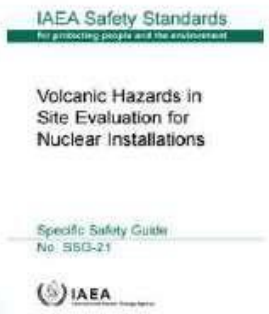
SSR-1 R17. Hazards due to volcanic activity that have the potential to affect the safety of the nuclear installation shall be evaluated.

- *Lava flow*
- *Pyroclastic flow*
- *Ground deformation*
- *Tephra fall*
- *Volcanic gases*
- *Lahars (massive)*



Sabancaya volcano erupting, Peru, 2017 (https://en.wikipedia.org/wiki/Volcano, CC BY 2.0)

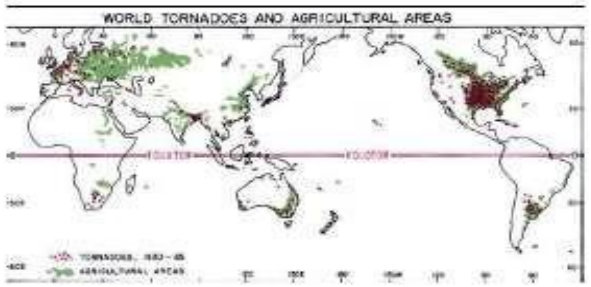
Capable volcano. A volcano that has a credible likelihood of undergoing future activity and producing hazardous phenomena, including non-eruptive phenomena, during the lifetime of a nuclear installation concerned, and which may potentially affect the site.



Bahaya External Alami – Aspek Meteorologi

SSR-1 R18. Extreme meteorological hazards and their possible combinations that have the potential to affect the safety of the nuclear installation shall be evaluated.

- *High straight wind*
- *Tornadoes*
- *Tropical storms*
- *Precipitation*
- *Sand and dust storms*



SSR-1 R19. Evaluation of rare meteorological events The potential for the occurrence of rare meteorological events such as lightning, tornadoes and cyclones, including information on their severity and frequency, shall be evaluated.

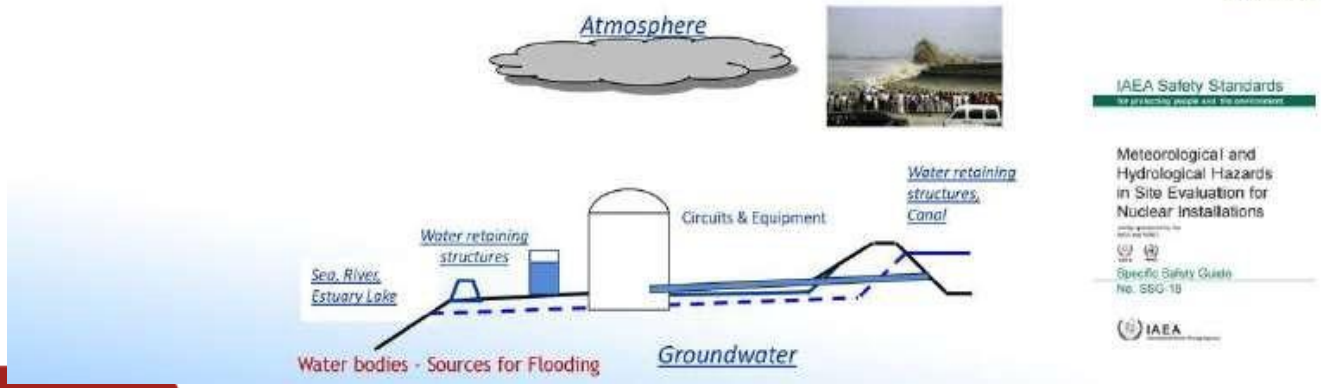
Bahaya External Alami – Aspek Hidrologi

SSR-1 R20. Evaluation of flooding hazards

Hazards due to flooding, considering natural and human induced events including their possible combinations, shall be evaluated.

- *Floods due to precipitation and other natural causes*
- *Water waves induced by earthquakes or other geological phenomena*
- *Floods and waves caused by failure of water control structures*

Fort Calhoun plant on June 16, 2011 during the 2011 Missouri River Floods; vital buildings were protected using water-filled perimeter "flood berms"
https://energynews.us/2020/08/31/report-climate-risks-compound-financial-challenges-for-midwest-nuclear-plants/



Aspek Dispersi

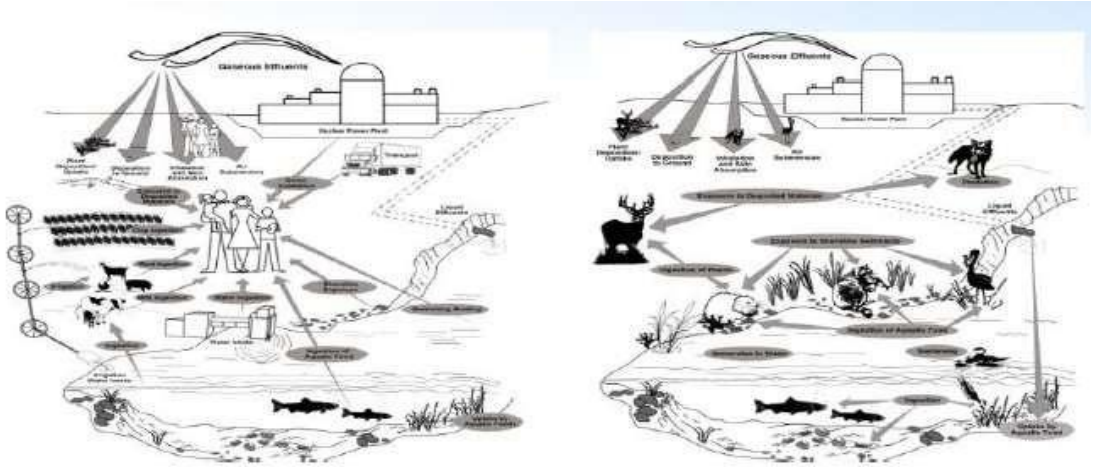
SSR-1 R25. **The dispersion in air and water of radioactive material** released from the nuclear installation in operational states and in accident conditions shall be assessed.

Evaluations to be done:

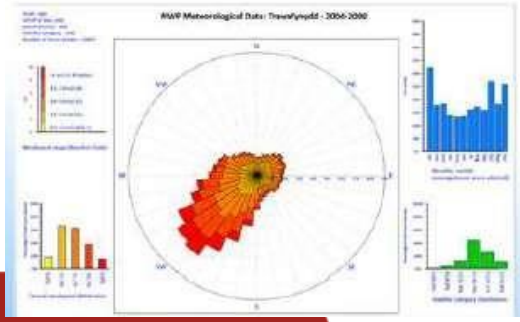
- *Atmospheric dispersion of radioactive material*
- *Dispersion of radioactive material through surface water and groundwater*

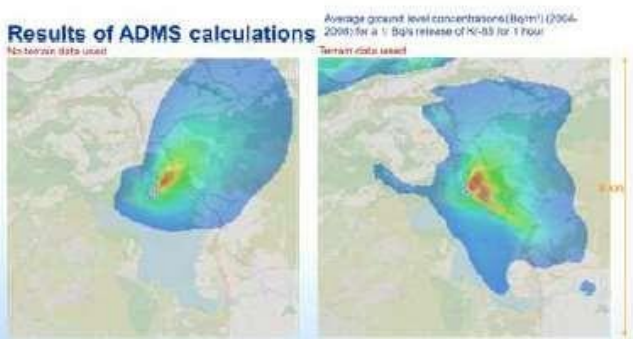
Site & Regional characteristics to be analysed:

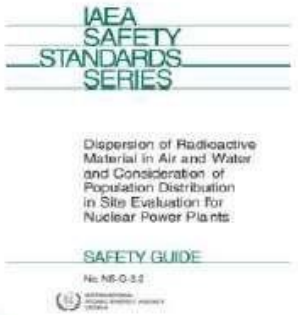
- *Orography, land cover & meteorological features*
- *Hydrogeological and hydrological features*



Exposure Pathways to Humans and biota





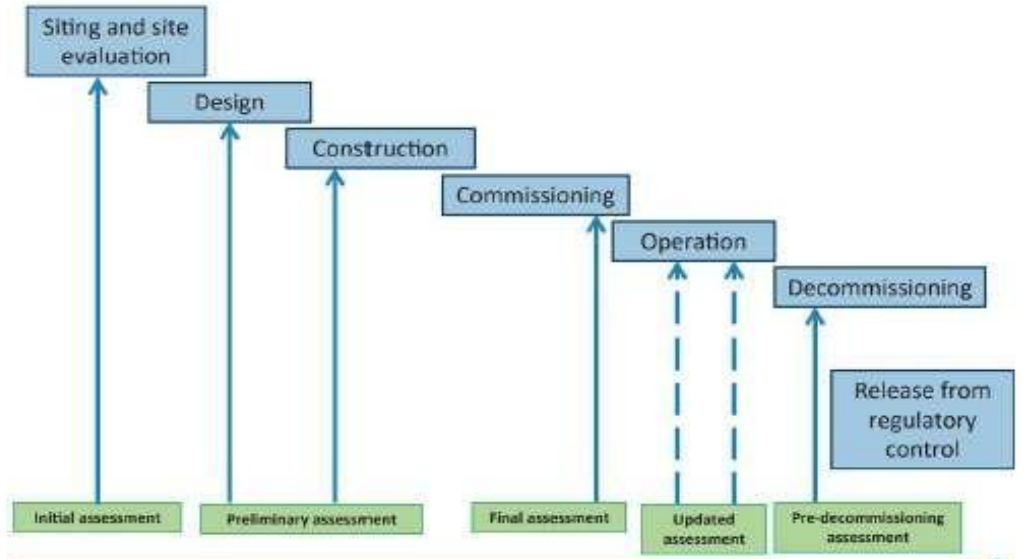


Aspek Populasi dan Penggunaan Lahan

SSR-1 R26. Population distribution and public exposure The existing and projected population distribution within the region over the lifetime of the nuclear installation shall be determined and the potential impact of radioactive releases on the public, in both operational states and accident conditions, shall be evaluated and periodically updated.

Key Considerations

- *Vulnerable population & residential institutions*
- *The most recent data on resident and transient population*
- *Population distribution in terms of direction and distance from the site*



REIA by stages in the lifetime of a nuclear installation (Figure 1, GSG-10)

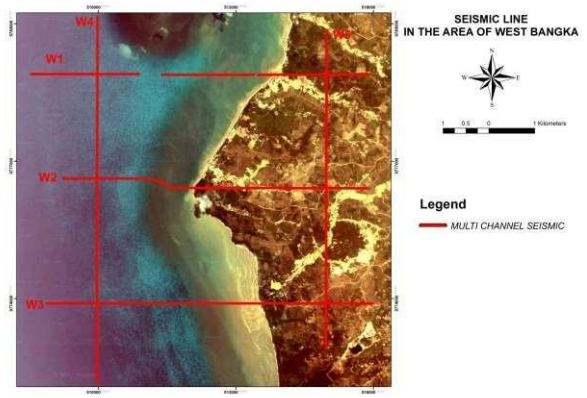
SSR-1 R27. The uses of land and water shall be characterized in order to assess the potential effects of the nuclear installation on the region.

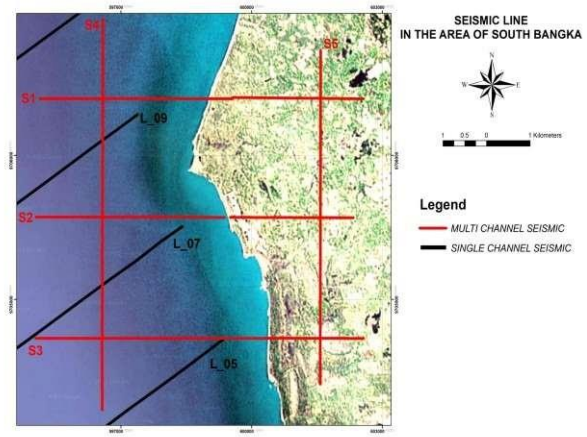
PEMILIHAN TAPAK PLTN DI INDONESIA

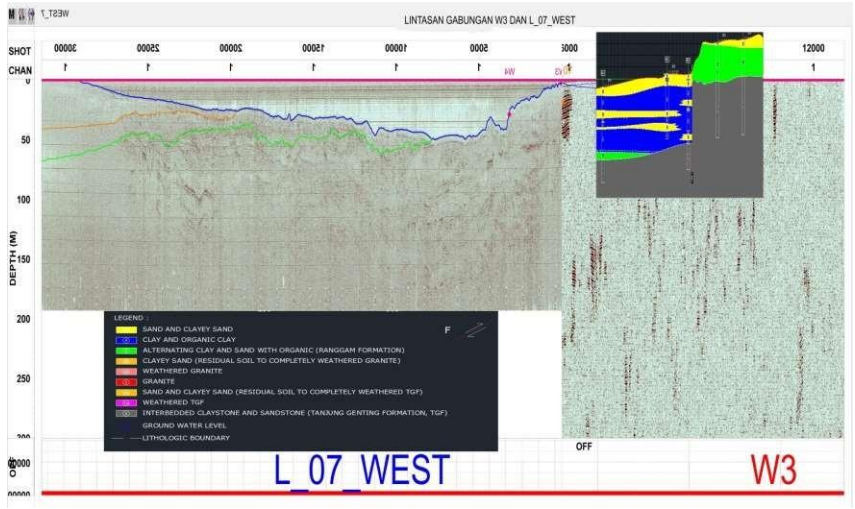
Pengeboran

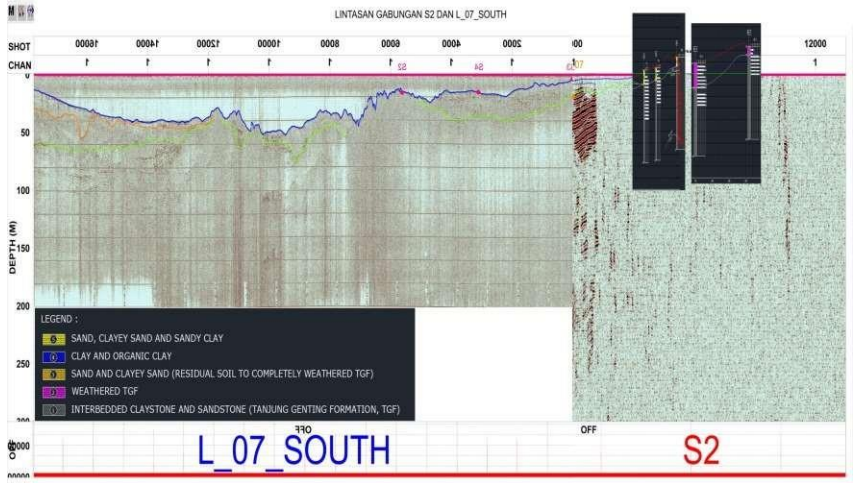
PEMILIHAN TAPAK PLTN DI INDONESIA

Seismik Refleksi



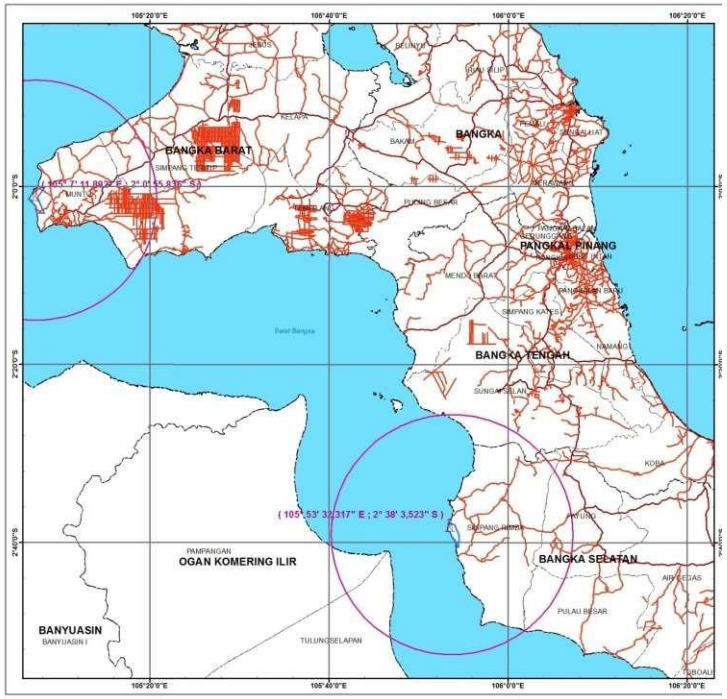


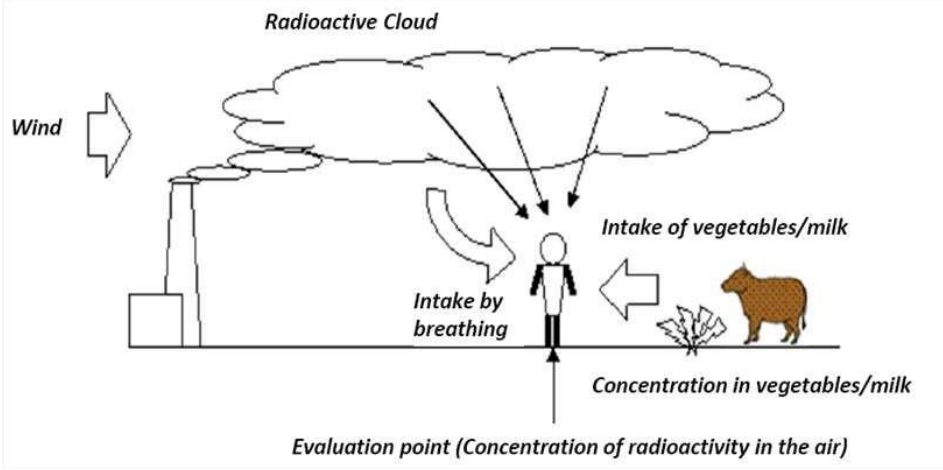




PEMILIHAN TAPAK PLTN DI INDONESIA

Monitoring Meteorologi



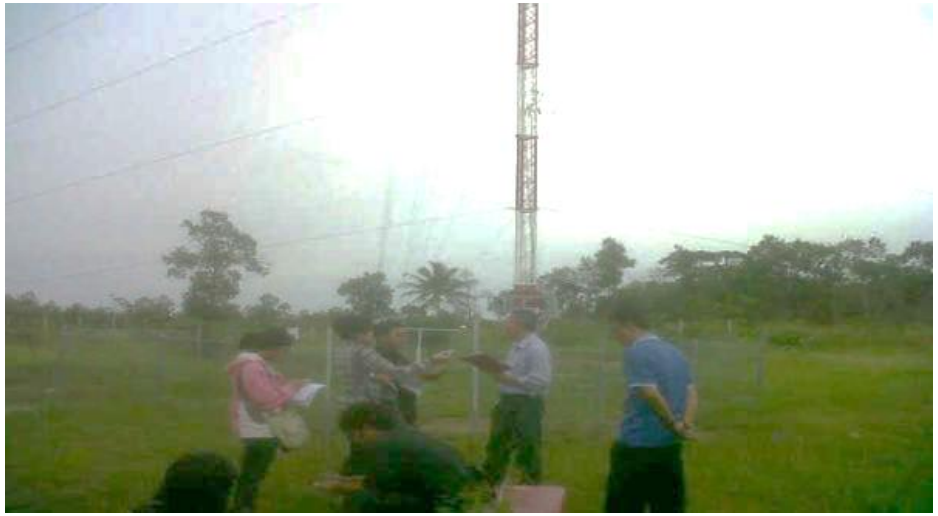


wind direction, wind speed, temperature for atmospheric stability

Daftar Isi

PENUTUP

Pemilihan dan Evaluasi Tapak
untuk instalasi nuklir merupakan proses yang **sangat penting**
dalam mendukung **keamanan** instalasi nuklir
sehingga dapat melindungi manusia dan lingkungan.




THANK YOU