# Containment Pressure after a Loss-of-Coolant Accident

Equilibrium containment pressure and temperature after the primary coolant blows down into the containment air, from an adiabatic energy and volume balance.

**Method:** Adiabatic energy and volume balance of a containment blowdown

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Mass of coolant released | 250.00 | t |
| Coolant pressure before release | 15.500 | MPa |
| Coolant temperature before release | 310.00 | °C |
| Containment free volume | 60,000 | m³ |
| Initial containment air pressure | 101.33 | kPa |
| Initial containment air temperature | 40.000 | °C |
| Gas constant of air | 0.28705 | kJ/(kg·K) |
| Specific heat of air at constant volume | 0.71800 | kJ/(kg·K) |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Final equilibrium temperature | 133.89 | °C |
| Final containment pressure (absolute) | 435.32 | kPa |
| Steam partial pressure | 303.26 | kPa |
| Air partial pressure | 132.06 | kPa |
| Fraction of the released water as steam | 39.914 | % |
| Mass of air | 67.633 | t |

### Notes for this case

• Adiabatic, rigid containment with no heat sinks or sprays: the internal energy of coolant and air is conserved and the water (specific volume V/m_w) ends as a saturated mixture at T. Real peaks are lower because walls and structures absorb heat; licensing analyses use transient codes. Water and steam properties from IAPWS-IF97.

## Formula and method

$$m_w u_{w,0} + m_a c_{v,a} T_{a0} = m_w \left[u_f + x(u_g - u_f)\right]_T + m_a c_{v,a} T, \quad x = \frac{V/m_w - v_f}{v_g - v_f}, \quad p = p_{sat}(T) + \frac{m_a R_a T}{V - m_w(1-x)v_f}$$

### Variables

| | | |
|---|---|---|
| $m_w$ | Mass of coolant released | kg |
| $p_w$ | Coolant pressure before release | Pa |
| $T_w$ | Coolant temperature before release | K |
| $V$ | Containment free volume | m³ |
| $p_{a0}$ | Initial containment air pressure | Pa |
| $T_{a0}$ | Initial containment air temperature | K |
| $R_a$ | Gas constant of air | J/(kg·K) |
| $c_{v,a}$ | Specific heat of air at constant volume | J/(kg·K) |
| $T$ | Final equilibrium temperature | K |
| $p$ | Final containment pressure (absolute) | Pa |

| | | |
|---|---|---|
| $p_s$ | Steam partial pressure | Pa |
| $p_a$ | Air partial pressure | Pa |
| $x$ | Fraction of the released water as steam | - |
| $m_a$ | Mass of air | kg |

### Method and standards

Containment energy balance.

### Assumptions and limits

- Adiabatic and rigid; uniform final state; dry initial air.

### References

Adiabatic energy and volume balance of a containment blowdown

## Report details

| | |
|---|---|
| Report reference | FCC-9ATG-3Y0T (the same inputs always give the same reference) |
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| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/boilers-power-plant/nuclear-power/containment-pressure-after-loca

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.