KRYPTOS

3D Fire & Gas Detection

3D Gas Mapping Validation Report

App Version

1.0.0

Date

19-11-2026

1 Introduction

Kryptos is a state-of-the-art 3D Fire and Gas Mapping software developed by Xalvic Advisors Private Limited for the engineering design, assessment and optimisation of fire and gas detection systems in industrial facilities. The software evaluates detector coverage within a three-dimensional representation of a facility, accounting for detector characteristics, gas cloud dimensions, detection ranges, obstructions and the spatial distribution of the areas requiring protection.

The accuracy and reliability of gas detection coverage calculations are fundamental to the engineering application of Kryptos. This document presents the validation of Kryptos' gas detection coverage calculations through comparison with independently derived analytical results for a series of representative test cases.

The validation cases have been selected to examine different gas detector configurations and geometric arrangements for which the expected coverage can be established analytically. The cases consider the relevant gas detection parameters, including detector type, detection range, gas cloud dimensions, detector placement and the coverage voting requirements. Both Point Gas Detectors (PGDs) and Open Path Gas Detectors (OPGDs) are considered, wherever applicable to the test cases.

For each test case, the analytical coverage is determined independently and compared against the corresponding coverage calculated by Kryptos. The results are presented quantitatively, with the deviation between the two values reported in percentage points. This provides a direct measure of the agreement between the software calculations and the analytical reference results.

Three-dimensional visualisations of the test configurations and calculated coverage are also included. These illustrate the spatial relationship between the gas detectors and the regions being assessed, and provide a visual representation of the coverage achieved at the respective detection voting levels.

The validation comprises 146 test cases and 294 individual coverage comparisons, encompassing the different risk grades, alarm-range and voting configurations considered. Across the results presented in this report, the mean and maximum deviation between the analytical and software-calculated coverage is 0.05 and 0.43 percentage points respectively.

This document is specifically concerned with the validation of gas detection coverage calculations in Kryptos. The validation of fire detection coverage calculations, which involves a separate set of calculation methodologies and analytical test cases, is addressed in a separate document.

2 Validation Scope

This validation examines the accuracy of gas detection coverage calculations for representative configurations involving different gas detector types and geometric arrangements.

The test cases are structured to assess the software's ability to calculate the proportion of a defined region covered by gas detectors, taking into account the applicable detector characteristics and gas mapping parameters.

The validation considers variations in the following aspects:

- **Detector Type:** Point Gas Detectors (PGDs) and Open Path Gas Detectors (OPGDs), as applicable to the test cases.
- **Detector Range:** The specified detection range of the gas detectors.
- **Gas Cloud Dimensions:** The dimensions of the gas cloud used to define the region being assessed.
- **Detector Position:** The position of the detector(s) relative to the gas cloud, geometric obstructions and the region being assessed.
- **Voting Requirements:** The minimum number of detectors required to detect a location for it to qualify as covered, as defined by the applicable voting logic.
- **Geometric Configuration:** The shape, dimensions and spatial arrangement of the regions being assessed, including the effect of physical obstructions wherever applicable.

The analytical coverage for each test case is independently established and compared with the corresponding results reported by Kryptos. The comparison is performed at the applicable voting levels, providing a quantitative assessment of the software's coverage calculations.

The individual test cases, their input parameters and the corresponding analytical and software results are presented in the subsequent sections of this document.

The test cases are grouped according to the Risk Grades included in each arrangement. Each group is evaluated under two alarm-range configurations: (i) a single detection range for each Risk Grade; and (ii) separate Low Alarm and High Alarm ranges for each Risk Grade.

3 Coverage Plot Legend

Each test case is illustrated using 3D views of the Risk Grades and gas detectors. The colours indicate the number of detectors that can detect each location within a Risk Grade.

Colour	Meaning
	Region is within the Risk Grade but not detected by any detector (0ooN)
	Detected by at least one detector (1ooN)
	Detected by at least two detectors (2ooN)
	Detected by at least three detectors (3ooN)
	Detected by at least four detectors (4ooN)
	Gas detector, labelled by its number

The orientation cube in the upper-right corner of each view indicates the directions of the X, Y and Z axes. Where a slice plot is used, it shows a planar section through the Risk Grades. The slice plane and its position are identified in the caption below the corresponding figure.

4 Abbreviations and Terms

Term	Meaning
PGD (Point Gas Detector)	A gas detector that monitors gas concentration at a specific point in space.
OPGD (Open Path Gas Detector)	A gas detector that monitors gas along an optical path between its transmitter and receiver.
Gas Component	The specific gas being assessed in the mapping calculation, such as Hydrocarbon (HC) or Hydrogen Sulphide (H_2S).

Term	Meaning
Gas Cloud Diameter (also Detection Range)	The specified diameter of the gas cloud used in the mapping calculation. For e.g., the gas cloud diameter that can lead to 150mbar or more overpressure as per the regulations. It is also the maximum distance within which a gas detector can detect the specified gas component, as defined by its configured parameters.
Risk Grade	A defined volume of a plant area for which gas detection coverage is assessed. In the cases presented here, a Risk Grade is represented by a cube or a cylinder. Each Risk Grade is assigned a Risk Grade Type.
Risk Grade Type	The classification assigned to a Risk Grade (for example, Gas Risk Grade A). Each Risk Grade Type has an associated detector range or gas cloud diameter.
Analytical Coverage (%)	The percentage of the Risk Grade volume calculated analytically that is detected (or covered) by the gas detector by being within the detector's range.
Software Coverage (%)	The percentage of the Risk Grade volume reported by Kryptos that is detected (or covered) by the gas detector.
Deviation	The difference between the analytical coverage and the software-calculated coverage, expressed in percentage points.
Voting Logic (1ooN, 2ooN, 3ooN, 4ooN)	Voting levels. For example, 2ooN means that a location is considered covered only if it is detected by at least two detectors. N denotes the total number of detectors considered in the configuration.
L and H (Low and High Alarm)	Low and High Alarm ranges. Each Risk Grade has a Low Alarm range (L) and a High Alarm range (H). A code such as LH indicates that one detector is evaluated using its Low Alarm range and another using its High Alarm range.

5 Normal Geographical Coverage Calculation

5.1 Single Grade

5.1.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside a cubical grade.

Risk Grades

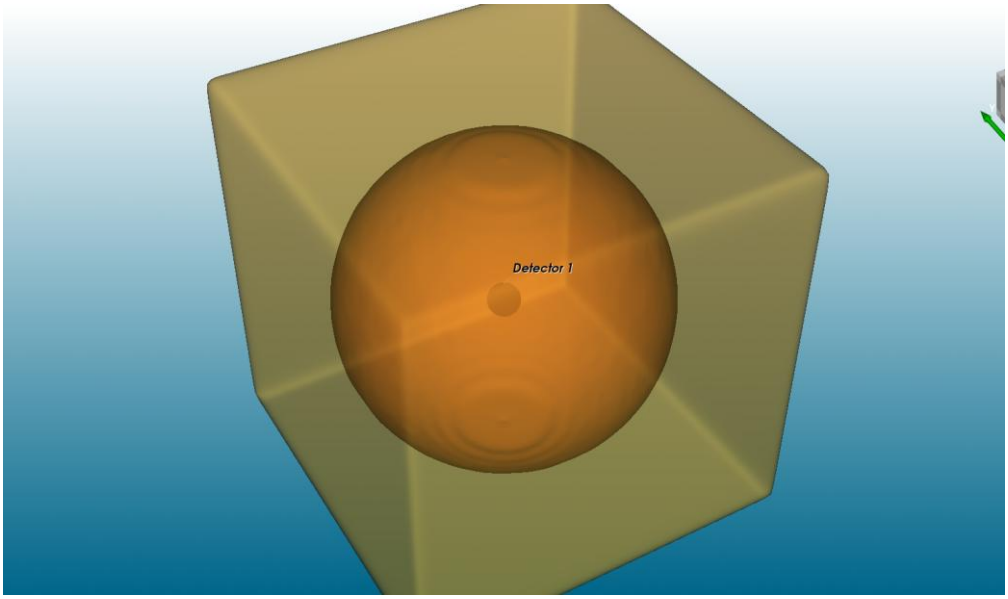
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	30.3	30.24	0.06



View 1

5.1.2 Two PGDs with non-interacting (FOI) completely inside a cubical grade.

Risk Grades

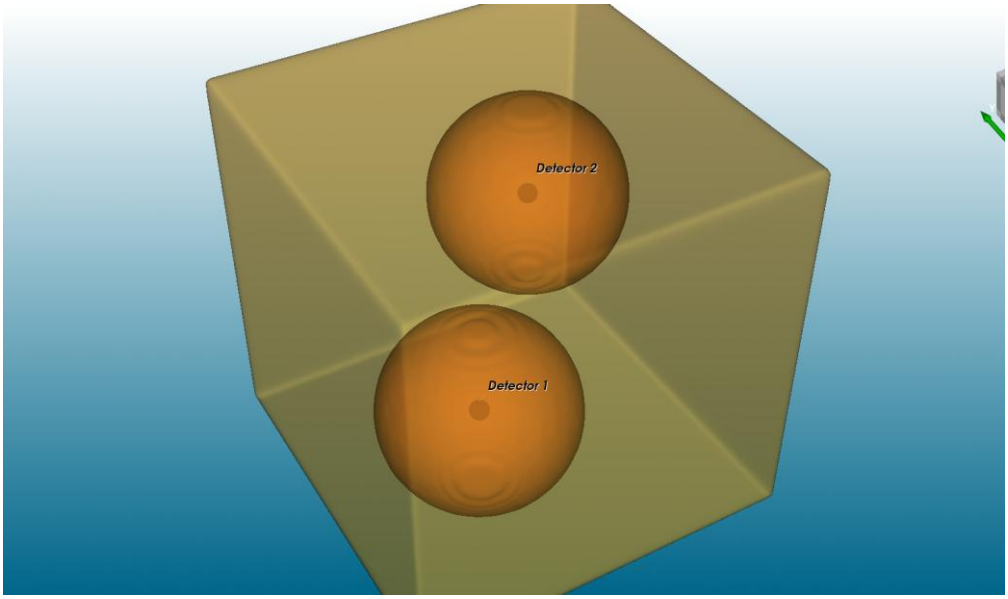
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m
Point Gas Detector (PGD)	HC	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	13.09	13.09	0.00



View 1

5.1.3 Two PGDs with one detector located at the edge of the FOI of the other detector. Cubical Grade used. 2ooN coverage assessed.

Risk Grades

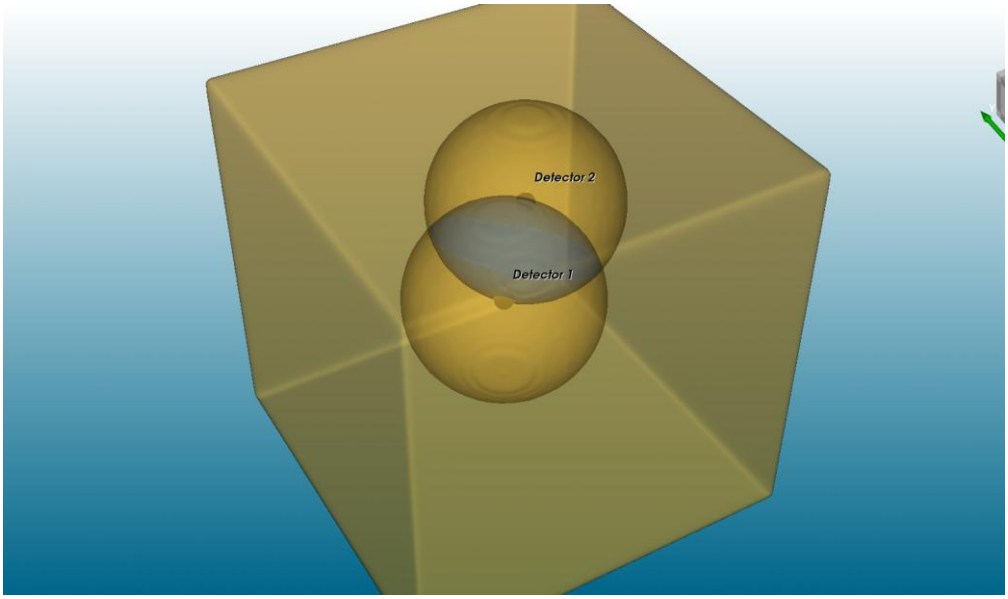
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade C - 10 m
Point Gas Detector (PGD)	HC	Grade C - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	2.05	2.04	0.01



View 1

5.1.4 One PGD located at the edge of a cubical grade. Exactly half portion of detector's FOI is outside the grade.

Risk Grades

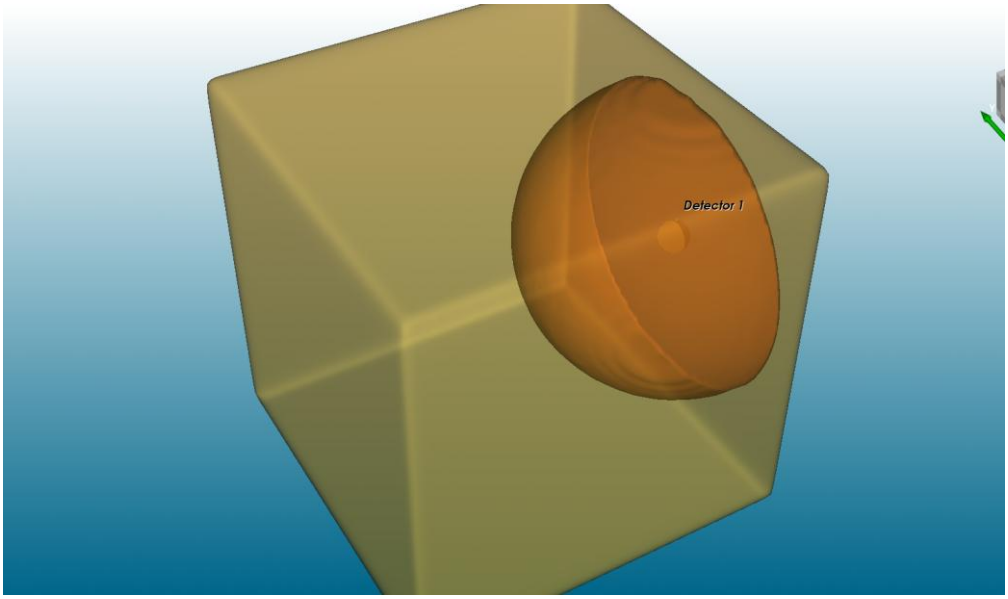
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	15.15	15.12	0.03



View 1

5.1.5 One Open Path Gas Detector (OPGD) with its FOI completely inside a cubical grade.

Risk Grades

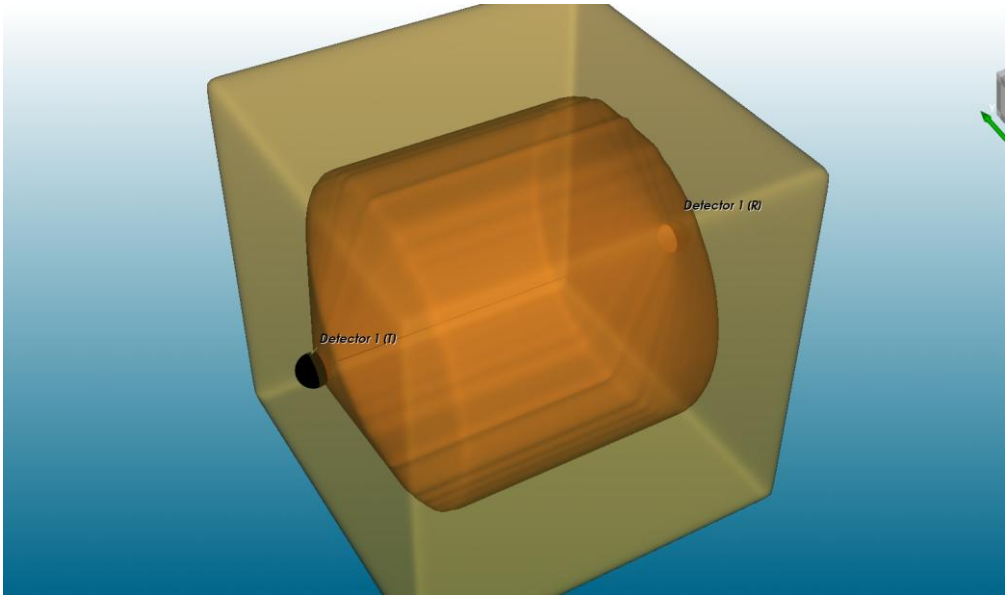
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	12 m	Grade B - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	42.42	42.18	0.24



View 1

5.1.6 Two OPGDs perpendicular to each other in a cubical grade

Risk Grades

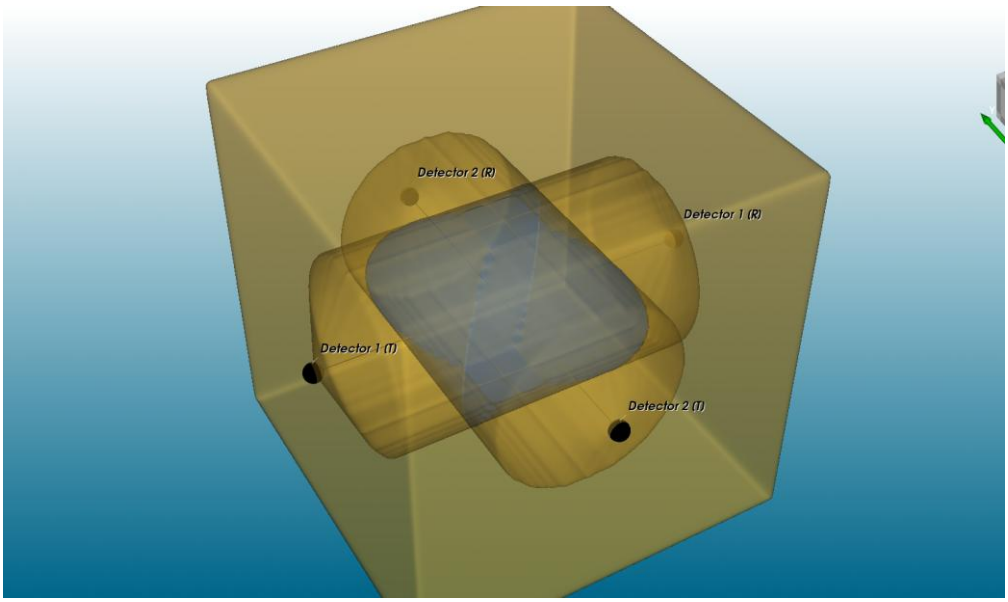
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	8.33	8.29	0.04



View 1

5.1.7 Two OPGDs parallel to each other in a cubical grade.

Risk Grades

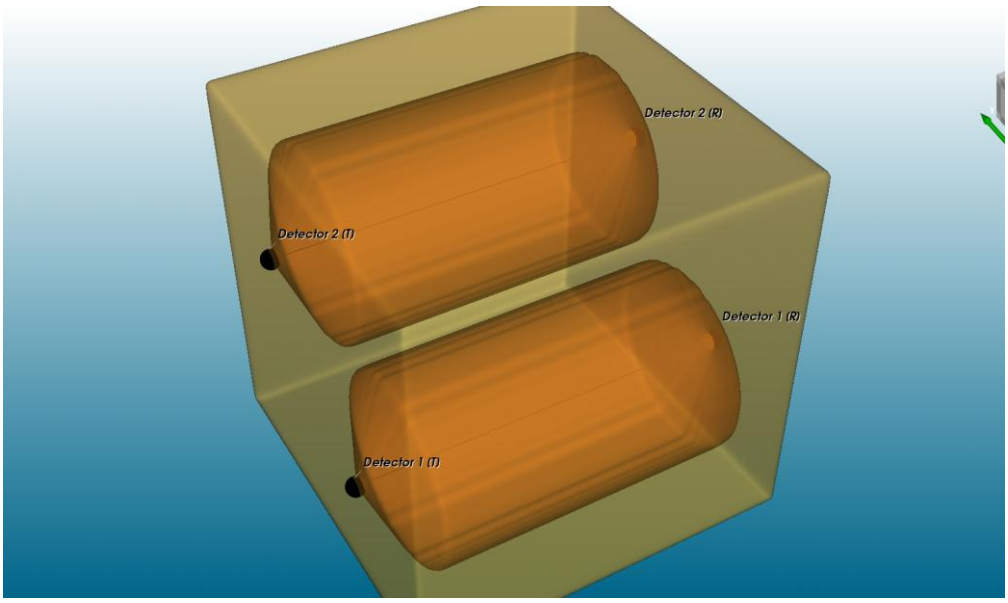
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - 10 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	34.03	34.08	0.05



View 1

5.1.8 One OPGD with half of FOI outside the cubical grade.

Risk Grades

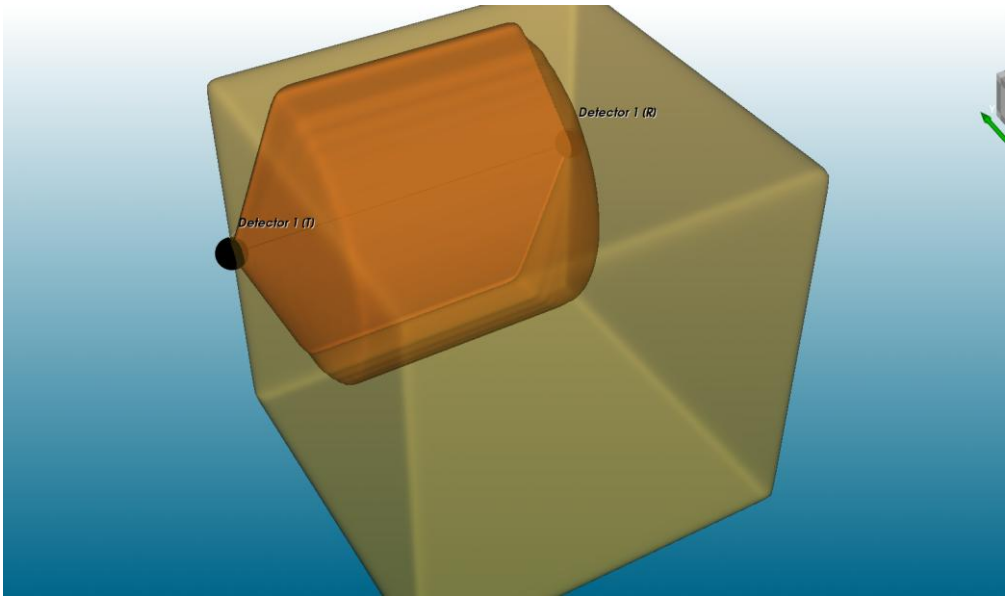
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	12 m	Grade A - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	21.21	21.09	0.12



View 1

5.1.9 One OPGD and one PGD with non-intersecting FOIs inside a cubical grade.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

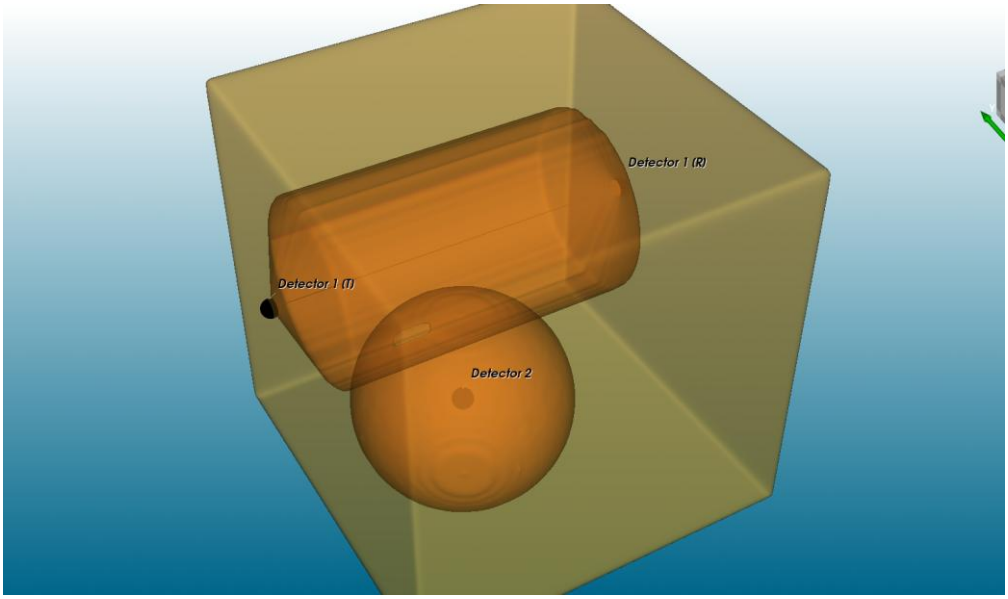
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - 10 m
Point Gas Detector (PGD)	HC	-	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	23.56	23.46	0.10

Note: Best-effort placement — an OPGD spanning the full grade width leaves no room for a point detector to be both fully contained and non-overlapping (see geometry.mjs module note). Expect a larger deviation here than the doc's original.



View 1

5.1.10 One OPGD and one PGD with overlapping FOIs inside a cubical grade. 2ooN coverage assessed.

Risk Grades

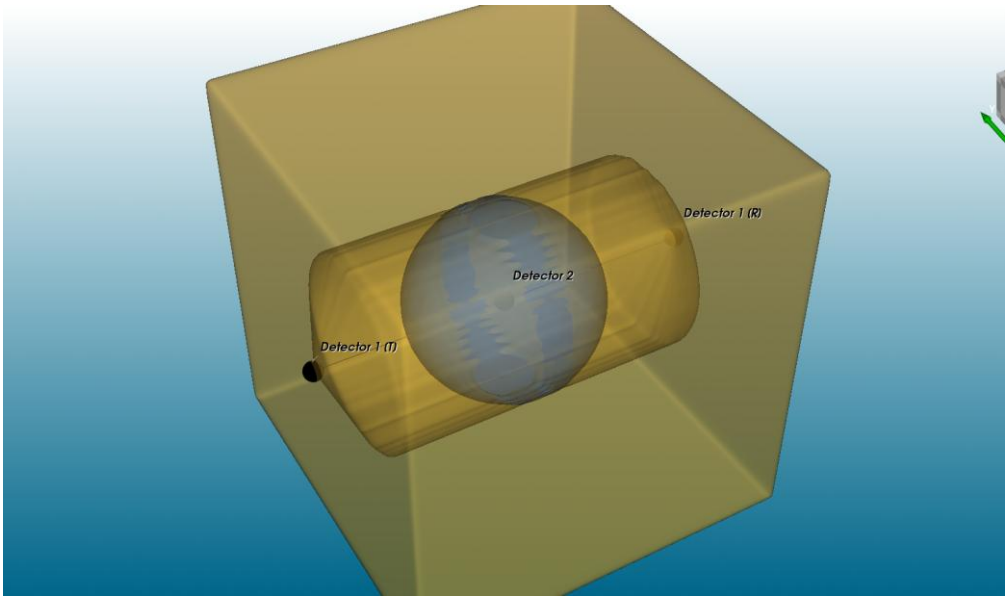
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - 10 m
Point Gas Detector (PGD)	HC	-	Grade A - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	2ooN	6.54	6.53	0.01



View 1

5.1.11 Two OPGDs parallel to each other and overlapping FOI inside a cubical grade. 2ooN coverage assessed.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

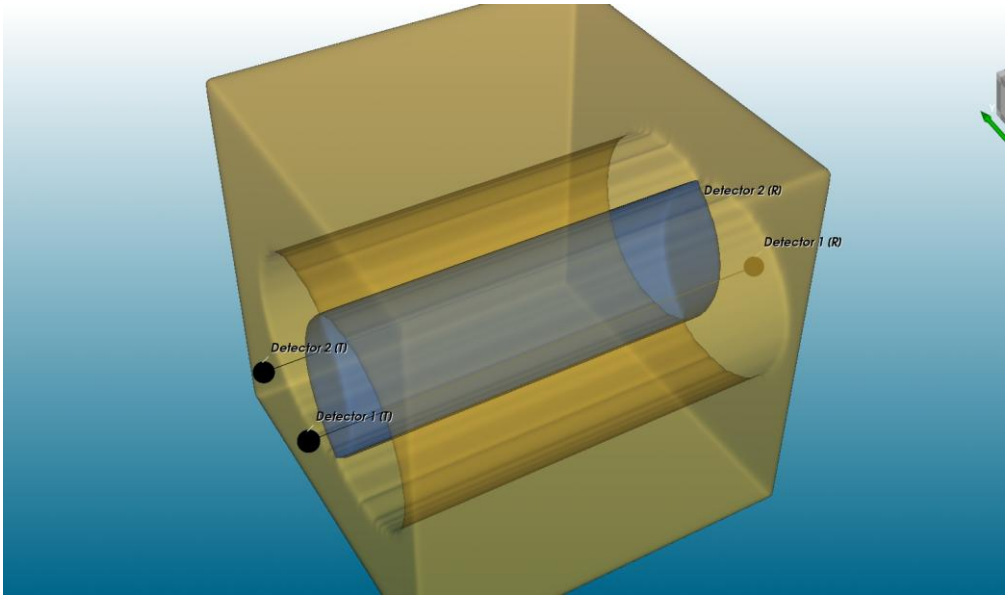
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	24 m	Grade B - 10 m
Open Path Gas Detector (OPGD)	HC	24 m	Grade B - 10 m

Analytical Formula: $(1.228 \times R^2 \times (\text{Range}-4)) / 80$

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	7.67	7.66	0.01



View 1

5.1.12 One PGD with its FOI completely inside a cylindrical grade.

Risk Grades

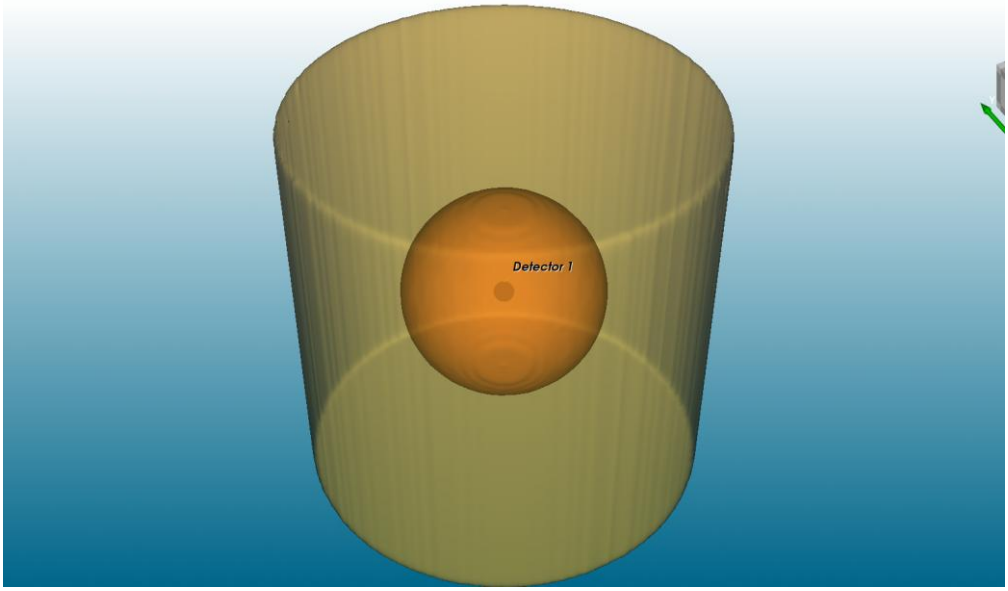
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	8.33	8.33	0.00



View 1

5.2 Two Grades of One Type

5.2.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside each grade

Risk Grades

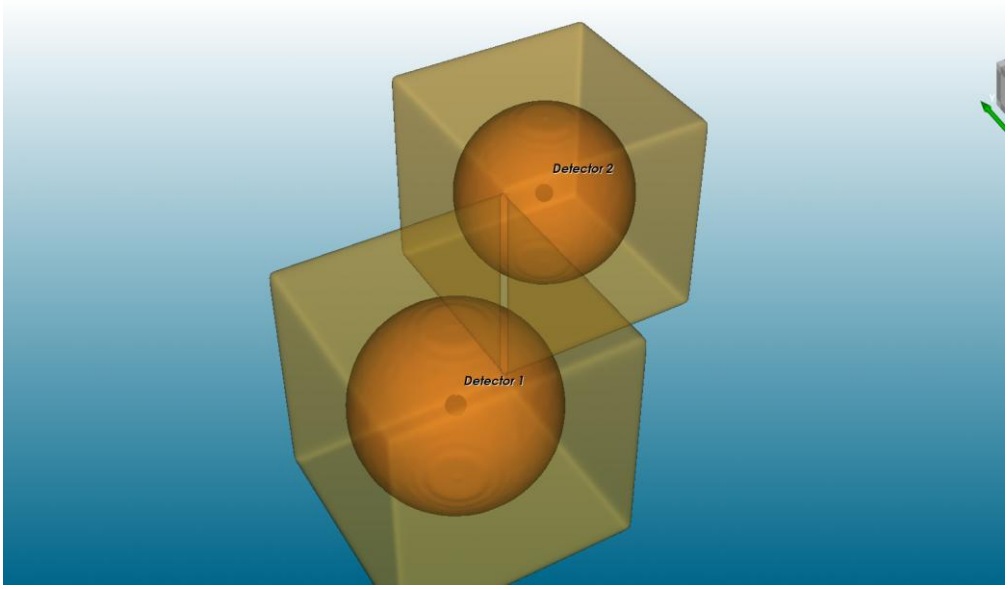
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade D - 10 m
Point Gas Detector (PGD)	H2	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	30.3	30.24	0.06



View 1

5.2.2 Two PGDs with non-interacting (FOI) completely inside each grade.

Risk Grades

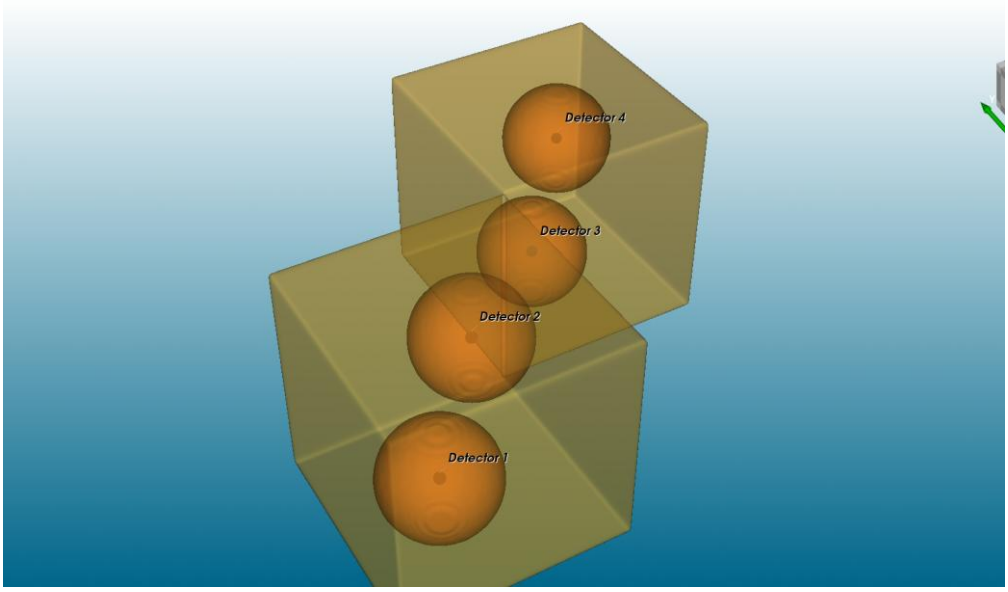
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade C - 10 m
Point Gas Detector (PGD)	H2	Grade C - 10 m
Point Gas Detector (PGD)	H2	Grade C - 10 m
Point Gas Detector (PGD)	H2	Grade C - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	13.09	13.09	0.00



View 1

5.2.3 Two PGDs inside each grade with one detector located at the edge of the FOI of the other detector. 2 Cubical Grades used. 2ooN coverage assessed.

Risk Grades

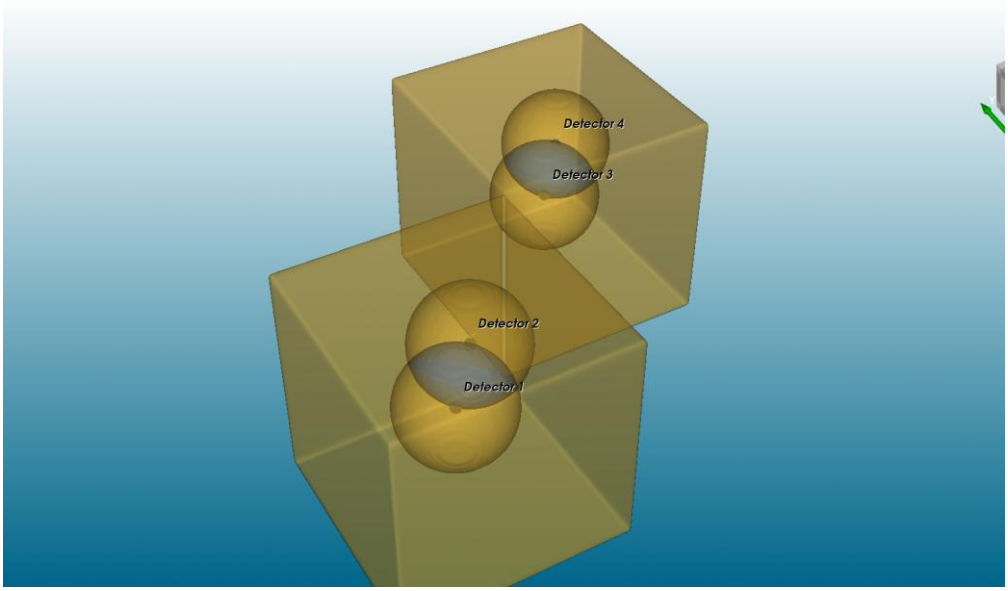
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade A - 10 m
Point Gas Detector (PGD)	H2	Grade A - 10 m
Point Gas Detector (PGD)	H2	Grade A - 10 m
Point Gas Detector (PGD)	H2	Grade A - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	2ooN	2.05	2.04	0.01



View 1

5.2.4 One PGD located at the edge of each cubical grade. Exactly half portion of detector's FOI is outside the respective grade.

Risk Grades

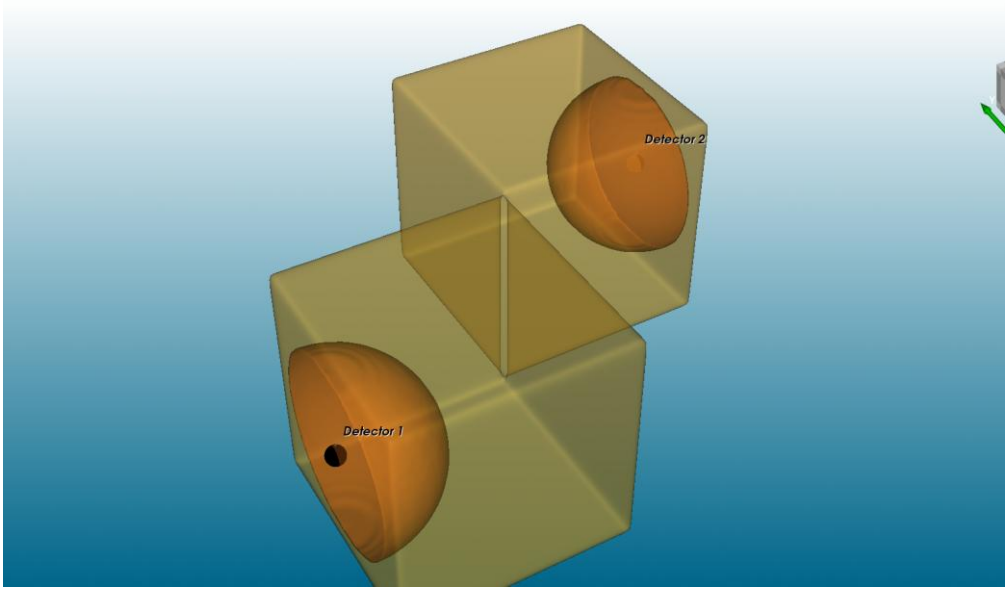
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade B - 10 m
Point Gas Detector (PGD)	H2	Grade B - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	15.15	15.12	0.03



View 1

5.2.5 One Open Path Gas Detector (OPGD) with its FOI completely inside each grade.

Risk Grades

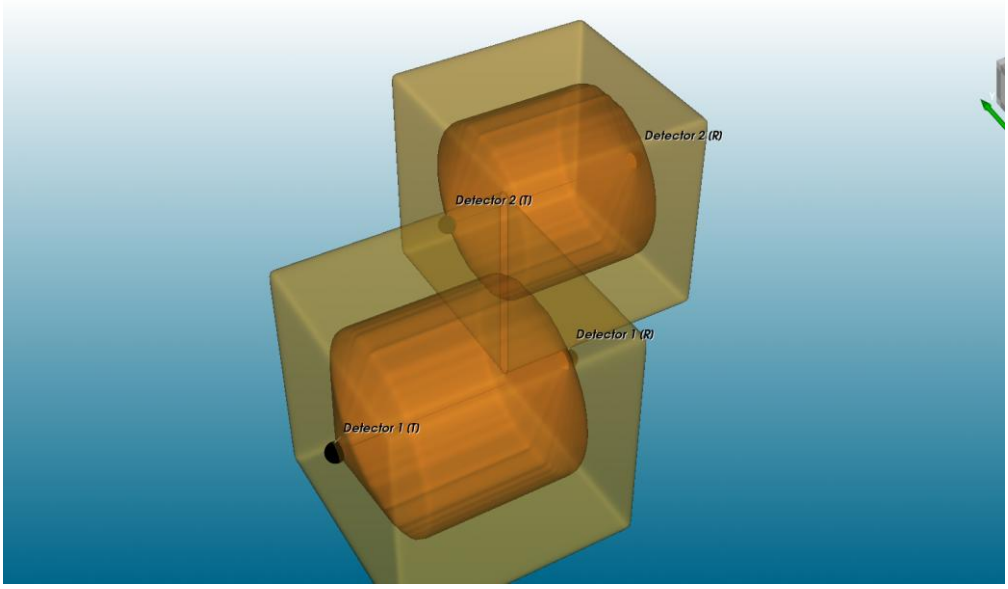
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	12 m	Grade D - 10 m
Open Path Gas Detector (OPGD)	H2	12 m	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	42.42	42.18	0.24



View 1

5.2.6 Two OPGDs perpendicular to each other inside each grade.

Risk Grades

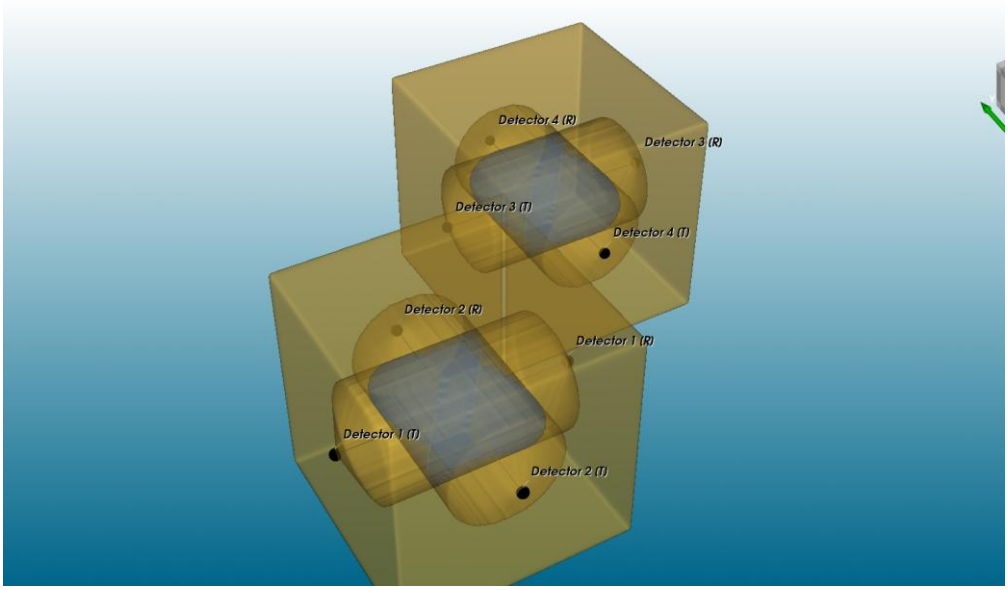
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	8.33	8.29	0.04


Detector 4 (R)
Detector 3 (R)
Detector 3 (T)
Detector 4 (T)
Detector 2 (R)
Detector 1 (R)
Detector 1 (T)
Detector 2 (T)

View 1

5.2.7 Two OPGDs parallel to each other inside each grade.

Risk Grades

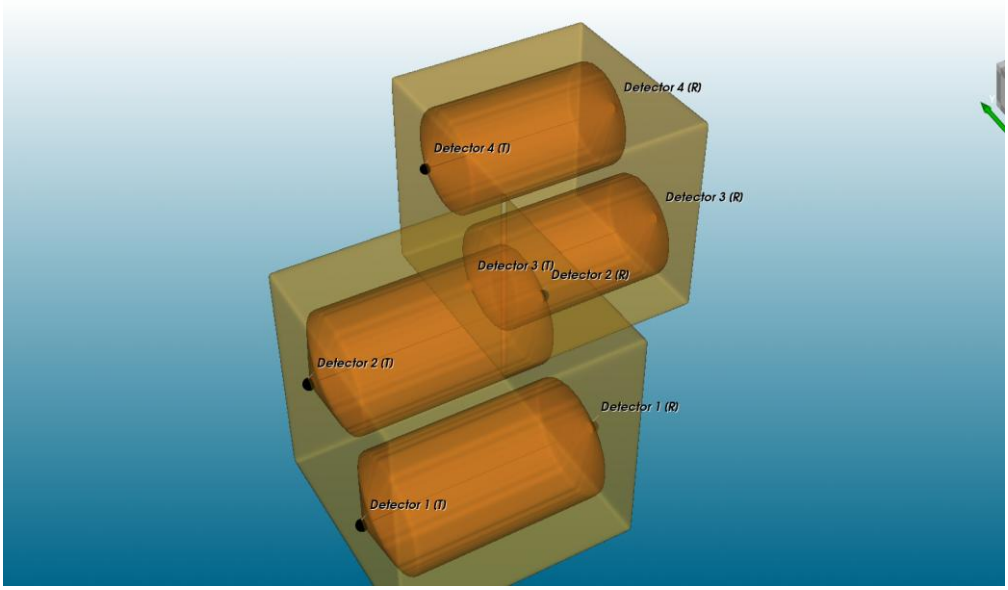
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	34.03	34.08	0.05


Detector 4 (R)
Detector 4 (T)
Detector 3 (R)
Detector 3 (T)
Detector 2 (R)
Detector 2 (T)
Detector 1 (R)
Detector 1 (T)

View 1

5.2.8 One OPGD inside each grade with half of detector's FOI outside the grade.

Risk Grades

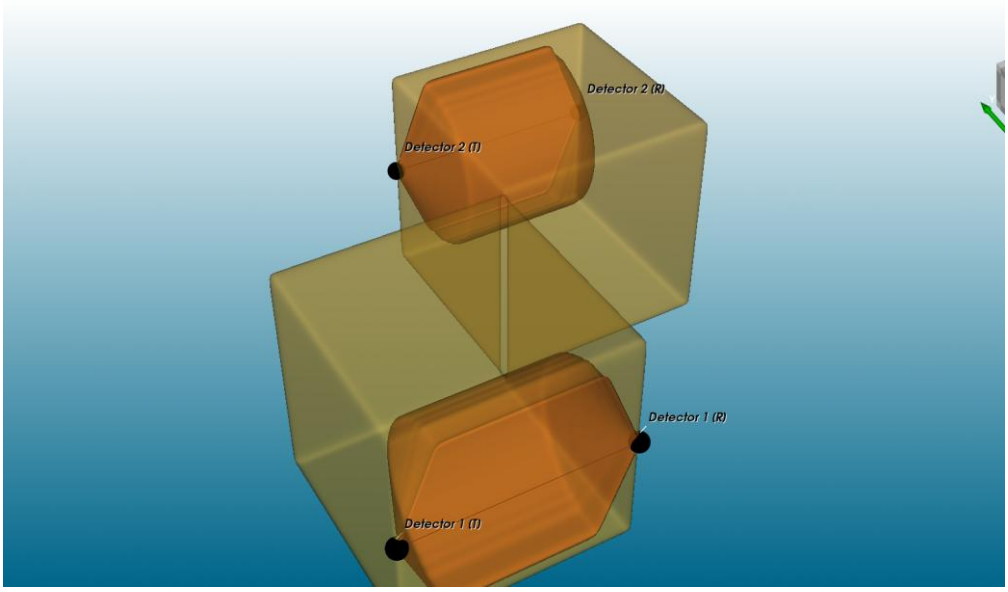
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade C
Cube	Length 12 m, Width 12 m, Height 12 m	Grade C

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	12 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	H2	12 m	Grade C - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	21.21	21.09	0.12



View 1

5.2.9 One OPGD and one PGD with non-intersecting FOIs inside each grade.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

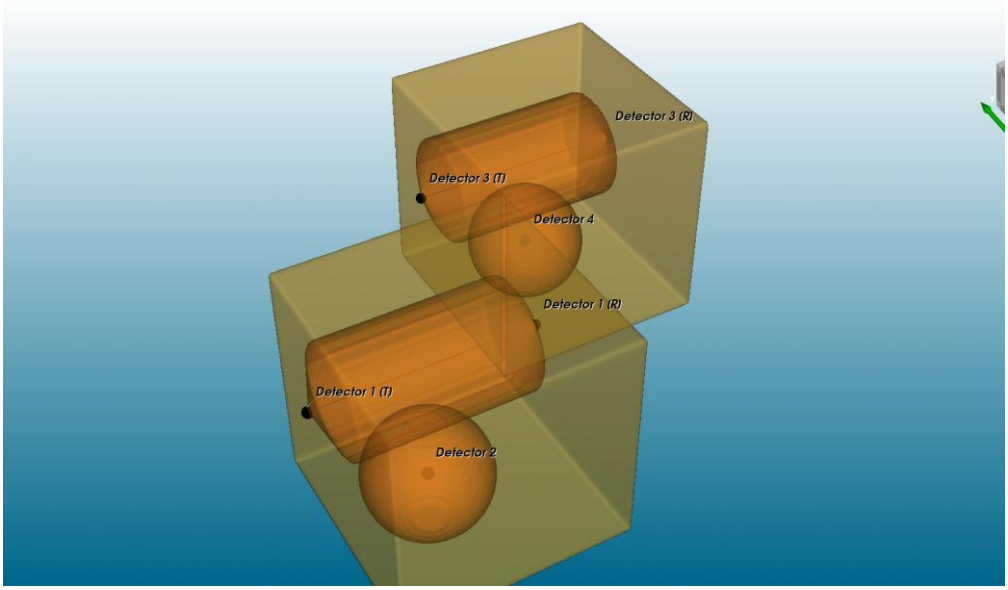
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade A - 10 m
Point Gas Detector (PGD)	H2	-	Grade A - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade A - 10 m
Point Gas Detector (PGD)	H2	-	Grade A - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	23.56	23.46	0.10

Note: Best-effort placement — see lib/geometry.mjs module note.


Detector 3 (R)
Detector 3 (T)
Detector 4
Detector 1 (R)
Detector 1 (T)
Detector 2

View 1

5.2.10 One OPGD and one PGD with overlapping FOIs inside each grade. 2ooN coverage assessed.

Risk Grades

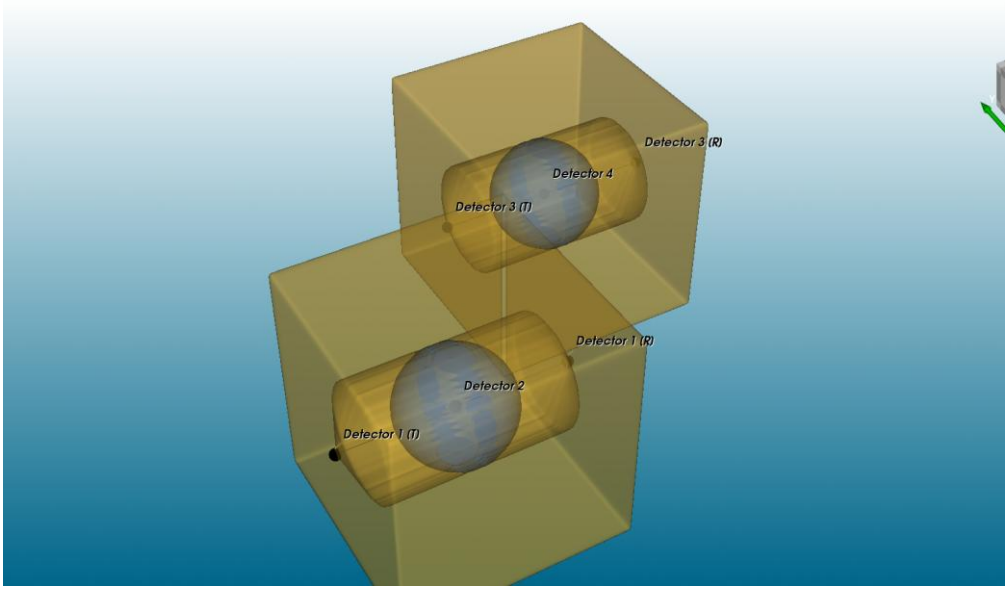
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - 10 m
Point Gas Detector (PGD)	H2	-	Grade D - 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - 10 m
Point Gas Detector (PGD)	H2	-	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	2ooN	6.54	6.53	0.01


Detector 3 (R)
Detector 4
Detector 3 (T)
Detector 1 (R)
Detector 2
Detector 1 (T)

View 1

5.2.11 Two OPGDs parallel to each other and overlapping FOI inside each grade. 2ooN coverage assessed.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

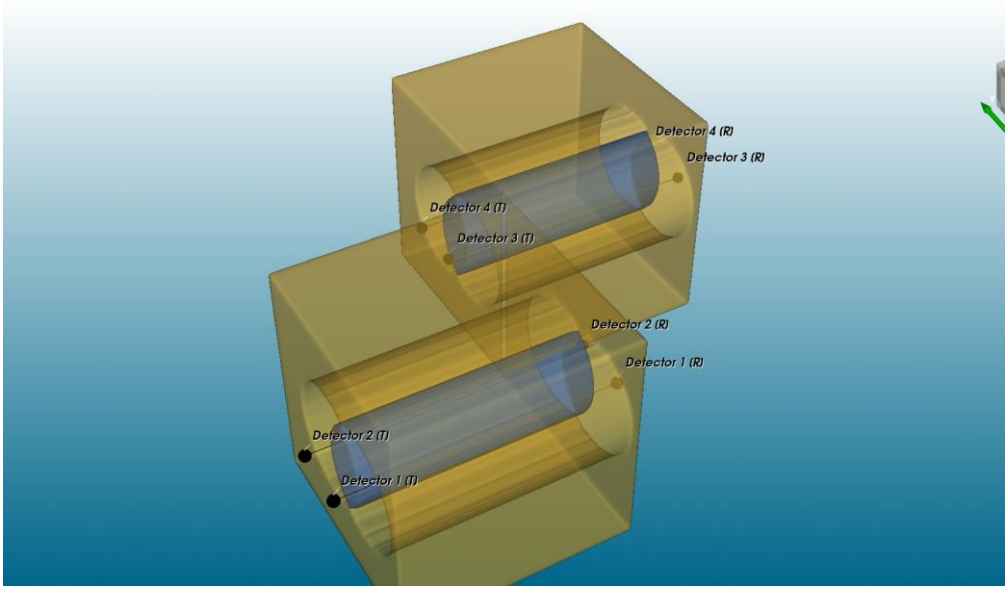
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	24 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	H2	24 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	H2	24 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	H2	24 m	Grade C - 10 m

Analytical Formula: $(1.228 \times R^2 \times (\text{Range}-4)) / 160$

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	7.67	7.66	0.01


Detector 4 (R)
Detector 3 (R)
Detector 4 (T)
Detector 3 (T)
Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

View 1

5.2.12 Two grades overlapping each other. One PGD with its FOI completely inside both the grades simultaneously.

Risk Grades

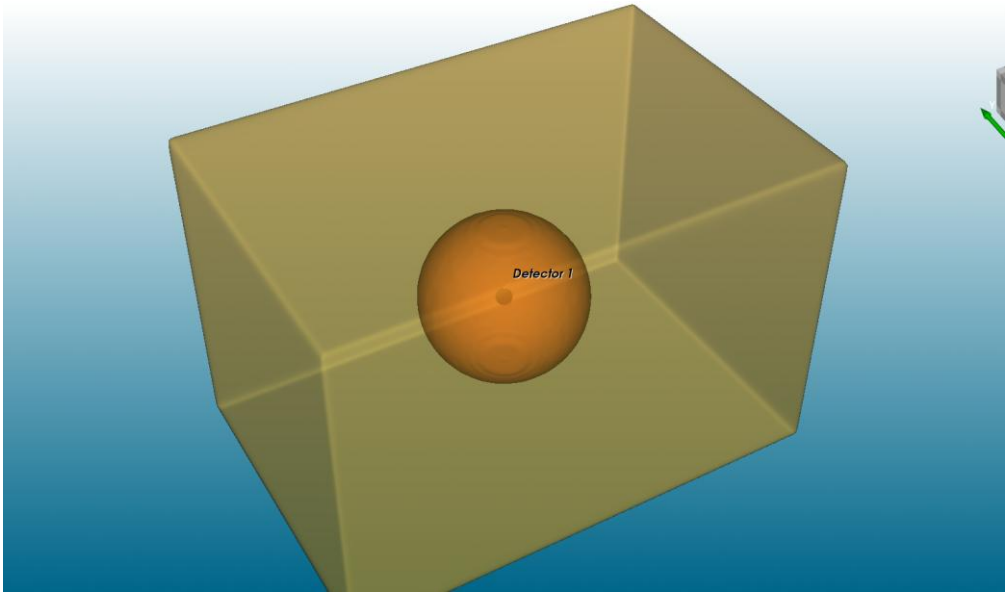
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	4.36	4.33	0.03



View 1

5.2.13 One PGD inside each cylindrical grade with its FOI completely inside the relelvant grade.

Risk Grades

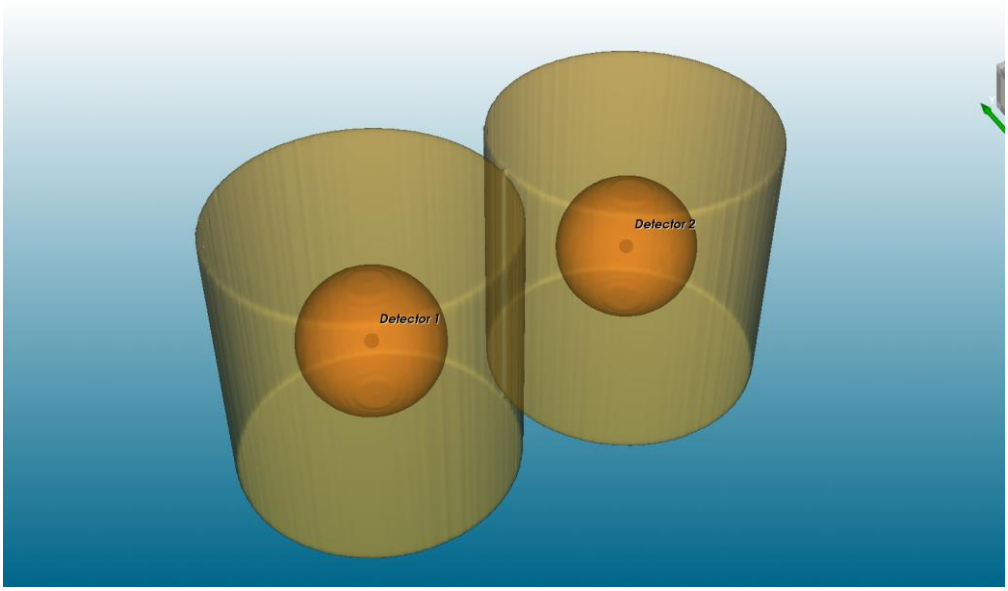
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade A
Cylinder	Radius 10 m, Height 20 m	Grade A

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade A - 10 m
Point Gas Detector (PGD)	H2	Grade A - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	8.33	8.33	0.00



View 1

5.3 Two Grades of Different Types

5.3.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside each grade

Risk Grades

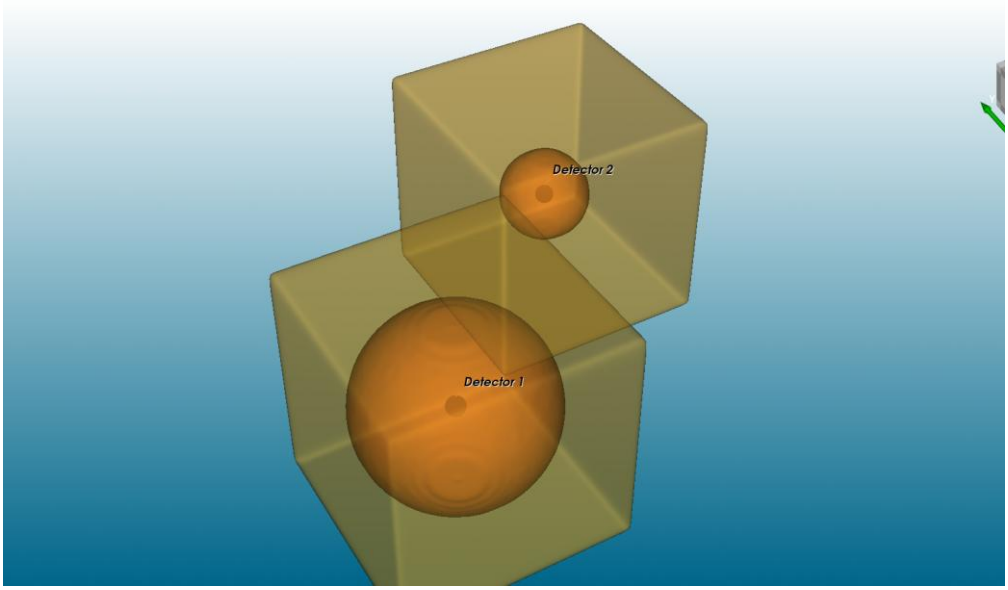
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade D - 10 m Grade B - 5 m
Point Gas Detector (PGD)	H2S	Grade D - 10 m Grade B - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	30.3	30.24	0.06
Grade B	1ooN	3.79	3.78	0.01



View 1

5.3.2 Two PGDs with non-interacting (FOI) completely inside each grade.

Risk Grades

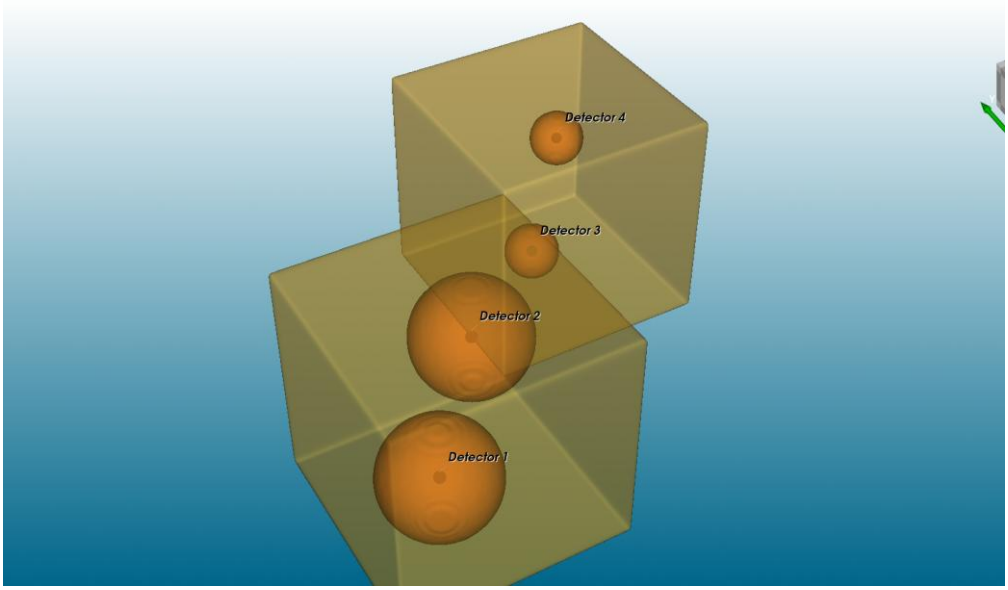
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade C - 10 m Grade A - 5 m
Point Gas Detector (PGD)	H2S	Grade C - 10 m Grade A - 5 m
Point Gas Detector (PGD)	H2S	Grade C - 10 m Grade A - 5 m
Point Gas Detector (PGD)	H2S	Grade C - 10 m Grade A - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	13.09	13.09	0.00
Grade A	1ooN	1.64	1.64	0.00



View 1

5.3.3 Two PGDs inside each grade with one detector located at the edge of the FOI of the other detector. 2 Cubical Grades used. 2ooN coverage assessed.

Risk Grades

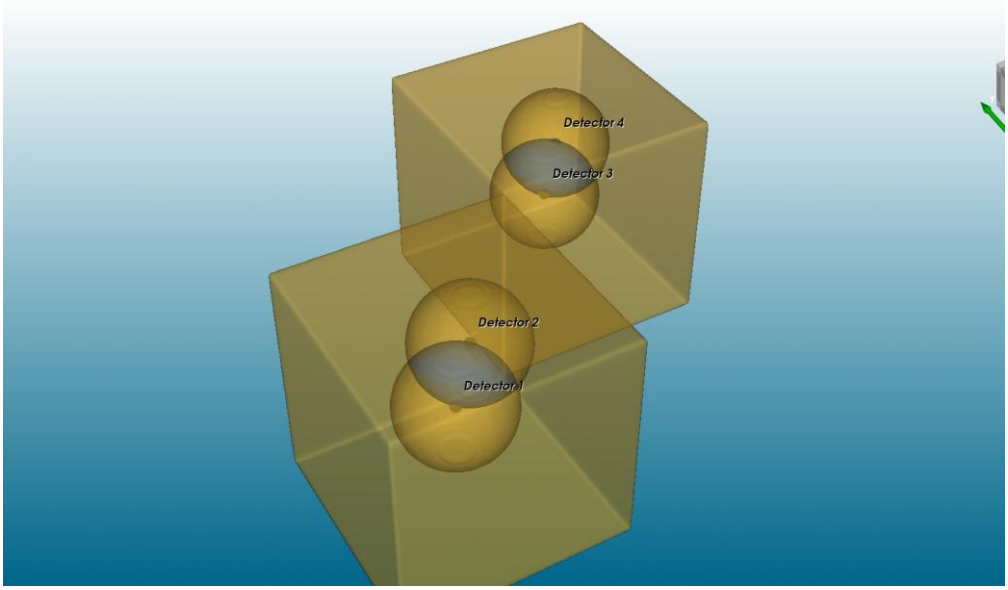
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade A - 10 m Grade B - 10 m
Point Gas Detector (PGD)	H2S	Grade A - 10 m Grade B - 10 m
Point Gas Detector (PGD)	H2S	Grade A - 10 m Grade B - 10 m
Point Gas Detector (PGD)	H2S	Grade A - 10 m Grade B - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	2ooN	2.05	2.04	0.01
Grade B	2ooN	2.05	2.04	0.01



View 1

5.3.4 One PGD located at the edge of each cubical grade. Exactly half portion of detector's FOI is outside the respective grade.

Risk Grades

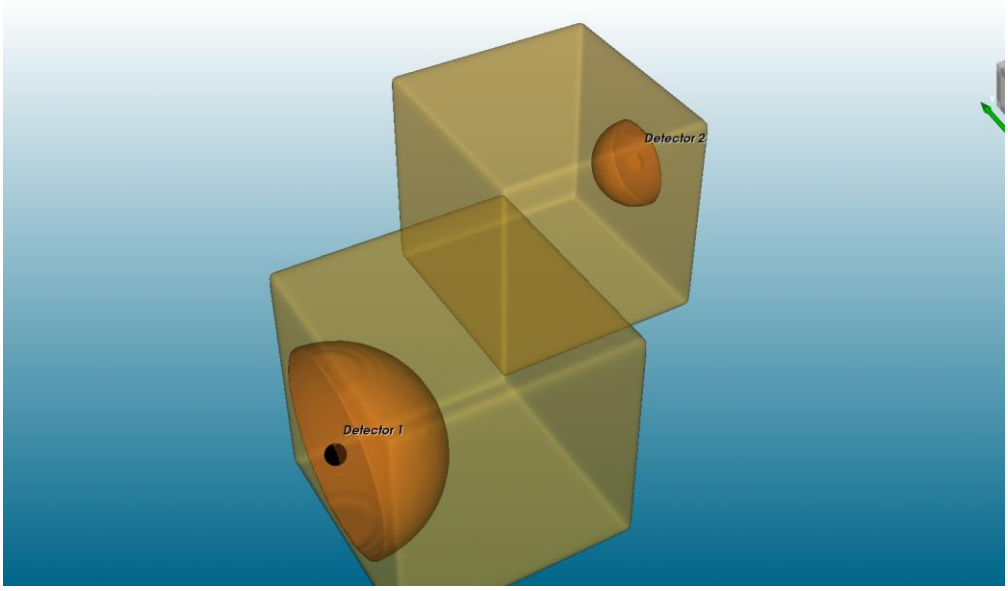
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade C
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade C - 10 m Grade B - 5 m
Point Gas Detector (PGD)	H2S	Grade C - 10 m Grade B - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	15.15	15.12	0.03
Grade B	1ooN	1.89	1.89	0.00



View 1

5.3.5 One Open Path Gas Detector (OPGD) with its FOI completely inside each grade.

Risk Grades

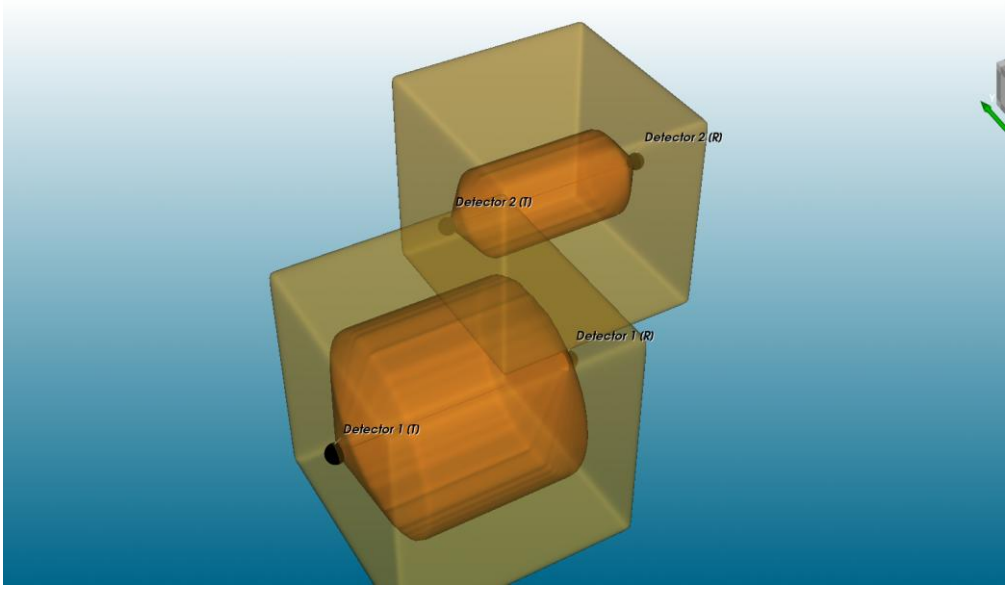
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	12 m	Grade A - 10 m Grade B - 5 m
Open Path Gas Detector (OPGD)	H2S	12 m	Grade A - 10 m Grade B - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	42.42	42.18	0.24
Grade B	1ooN	10.61	10.48	0.13



View 1

5.3.6 Two OPGDs perpendicular to each other inside each grade.

Risk Grades

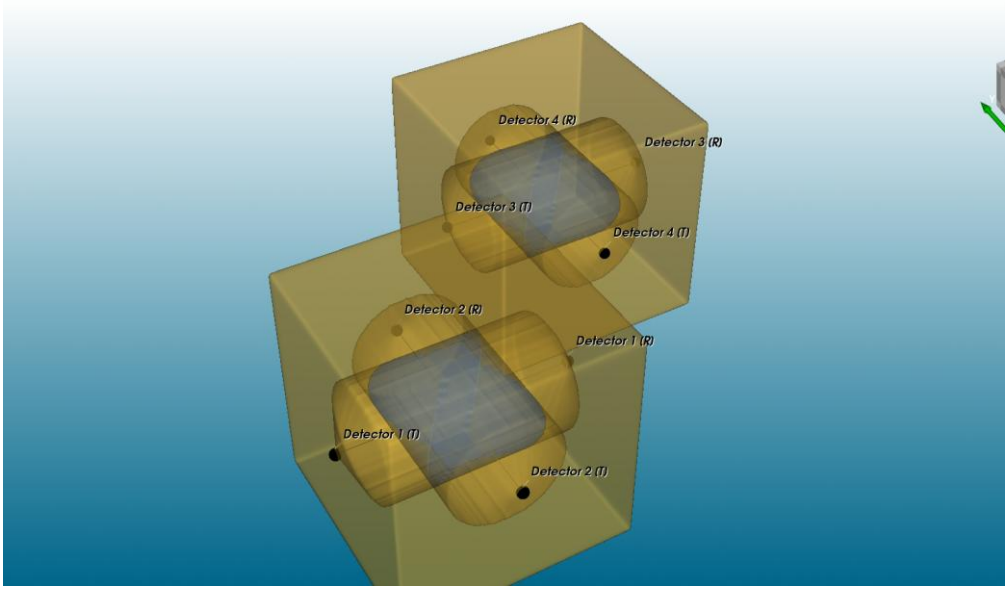
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade C - 10 m Grade D - 10 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade C - 10 m Grade D - 10 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade C - 10 m Grade D - 10 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade C - 10 m Grade D - 10 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	8.33	8.29	0.04
Grade D	2ooN	8.33	8.29	0.04


Detector 4 (R)
Detector 3 (R)
Detector 3 (T)
Detector 4 (T)
Detector 2 (R)
Detector 1 (R)
Detector 1 (T)
Detector 2 (T)

View 1

5.3.7 Two OPGDs parallel to each other inside each grade.

Risk Grades

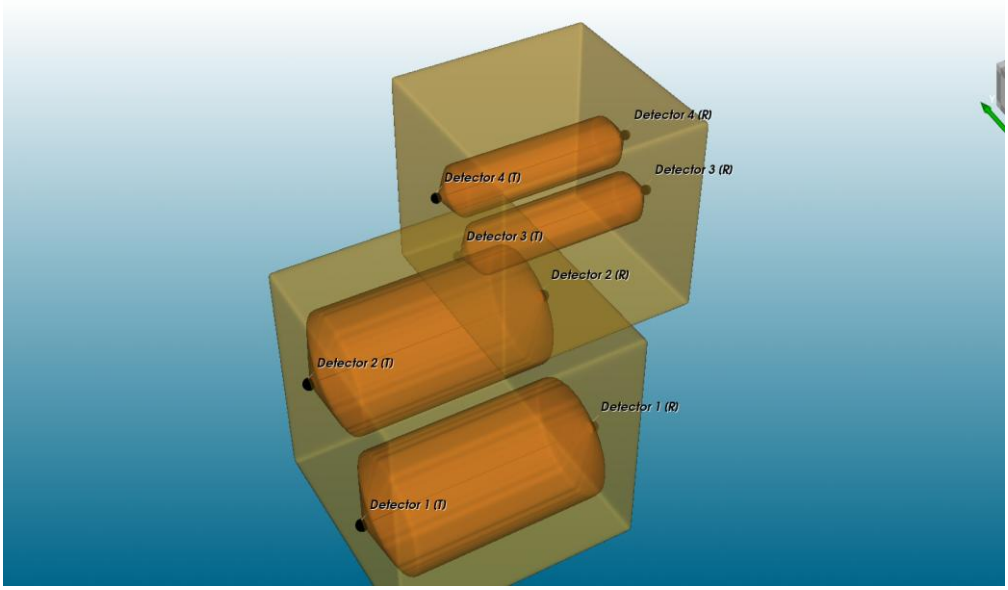
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - 10 m Grade D - 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - 10 m Grade D - 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - 10 m Grade D - 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - 10 m Grade D - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	34.03	34.08	0.05
Grade D	1ooN	8.51	8.52	0.01


Detector 4 (R)
Detector 4 (T)
Detector 3 (R)
Detector 3 (T)
Detector 2 (R)
Detector 2 (T)
Detector 1 (R)
Detector 1 (T)

View 1

5.3.8 One OPGD inside each grade with half of detector's FOI outside the grade.

Risk Grades

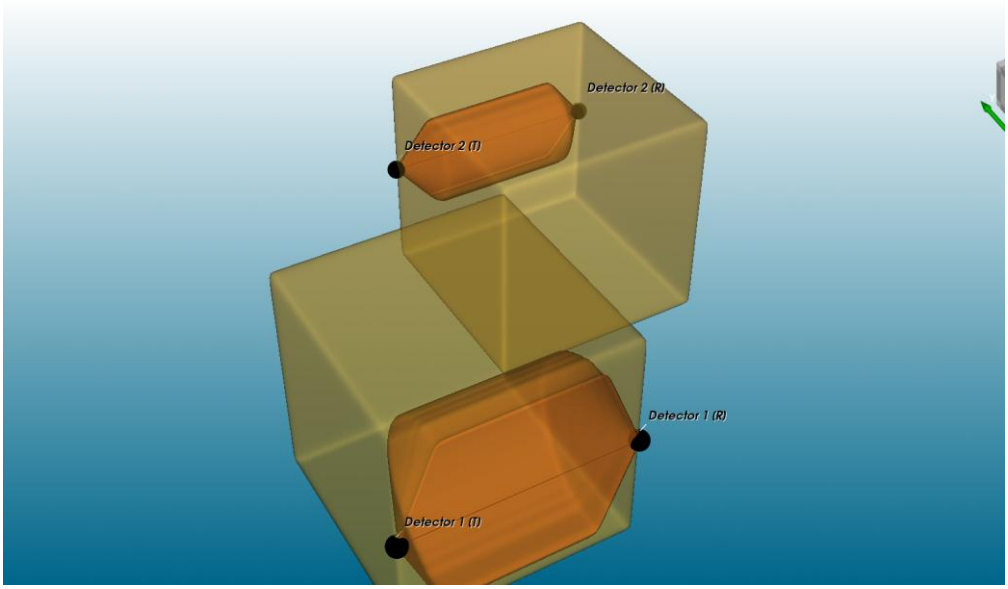
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	12 m	Grade A - 10 m Grade D - 5 m
Open Path Gas Detector (OPGD)	H2S	12 m	Grade A - 10 m Grade D - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	21.21	21.09	0.12
Grade D	1ooN	5.3	5.24	0.06



View 1

5.3.9 One OPGD and one PGD with non-intersecting FOIs inside each grade.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

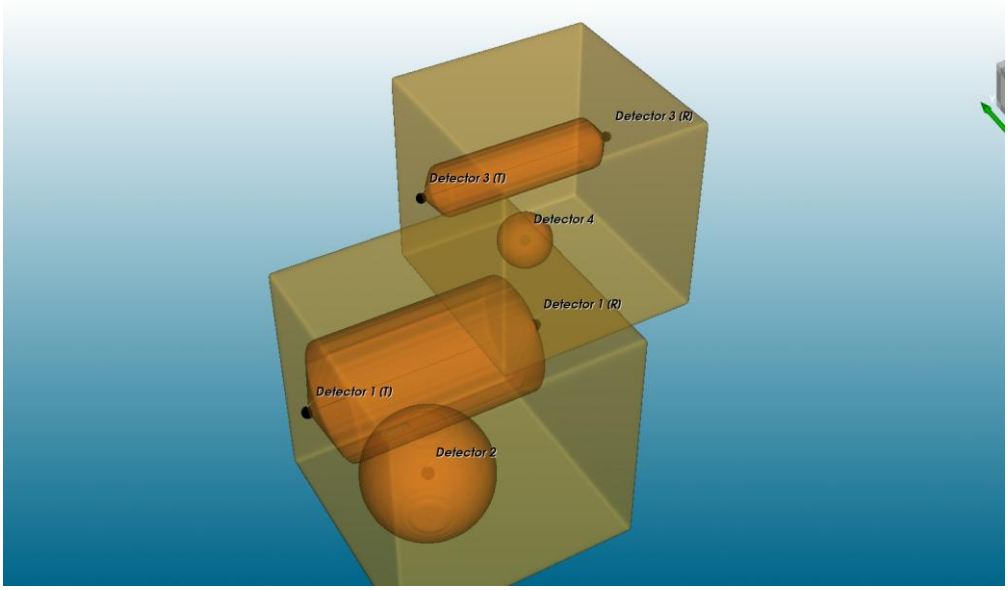
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade A - 10 m Grade C - 5 m
Point Gas Detector (PGD)	H2S	-	Grade A - 10 m Grade C - 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade A - 10 m Grade C - 5 m
Point Gas Detector (PGD)	H2S	-	Grade A - 10 m Grade C - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	23.56	23.46	0.10
Grade C	1ooN	5.07	5.02	0.05

Note: Best-effort placement — see lib/geometry.mjs module note.


Detector 3 (R)
Detector 3 (T)
Detector 4
Detector 1 (R)
Detector 1 (T)
Detector 2

View 1

5.3.10 One OPGD and one PGD with overlapping FOIs inside each grade. 2ooN coverage assessed.

Risk Grades

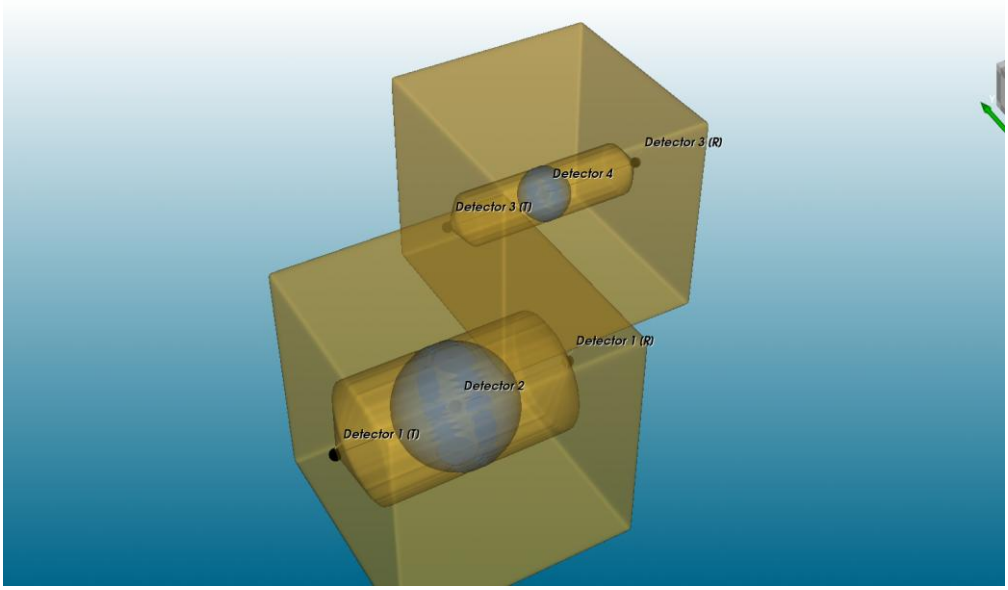
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - 10 m Grade D - 5 m
Point Gas Detector (PGD)	H2S	-	Grade B - 10 m Grade D - 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - 10 m Grade D - 5 m
Point Gas Detector (PGD)	H2S	-	Grade B - 10 m Grade D - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	6.54	6.53	0.01
Grade D	2ooN	0.8	0.82	0.02


Detector 3 (R)
Detector 4
Detector 3 (T)
Detector 1 (R)
Detector 2
Detector 1 (T)

View 1

5.3.11 Two OPGDs parallel to each other and overlapping FOI inside each grade. 2ooN coverage assessed.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

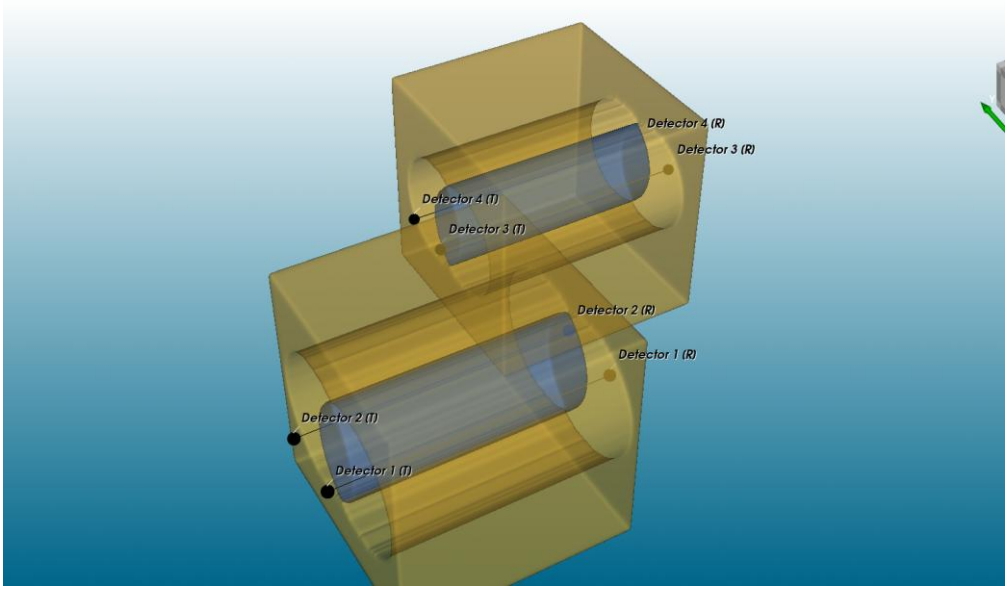
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	24 m	Grade C - 12 m Grade A - 10 m
Open Path Gas Detector (OPGD)	H2S	24 m	Grade C - 12 m Grade A - 10 m
Open Path Gas Detector (OPGD)	H2S	24 m	Grade C - 12 m Grade A - 10 m
Open Path Gas Detector (OPGD)	H2S	24 m	Grade C - 12 m Grade A - 10 m

Analytical Formula: $(1.228 \times R^2 \times (\text{Range}-4)) / 80$

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	11.05	11.03	0.02
Grade A	2ooN	7.67	7.66	0.01


Detector 4 (R)
Detector 3 (R)
Detector 4 (T)
Detector 3 (T)
Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

View 1

5.3.12 Two grades overlapping each other. One PGD with its FOI completely inside both the grades simultaneously.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

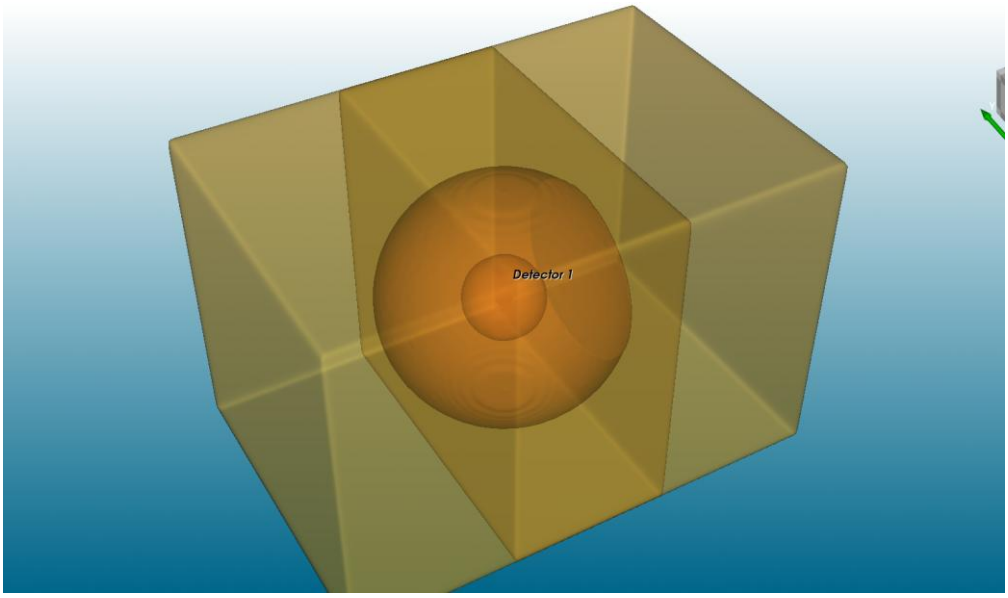
Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade C - 15 m Grade D - 5 m

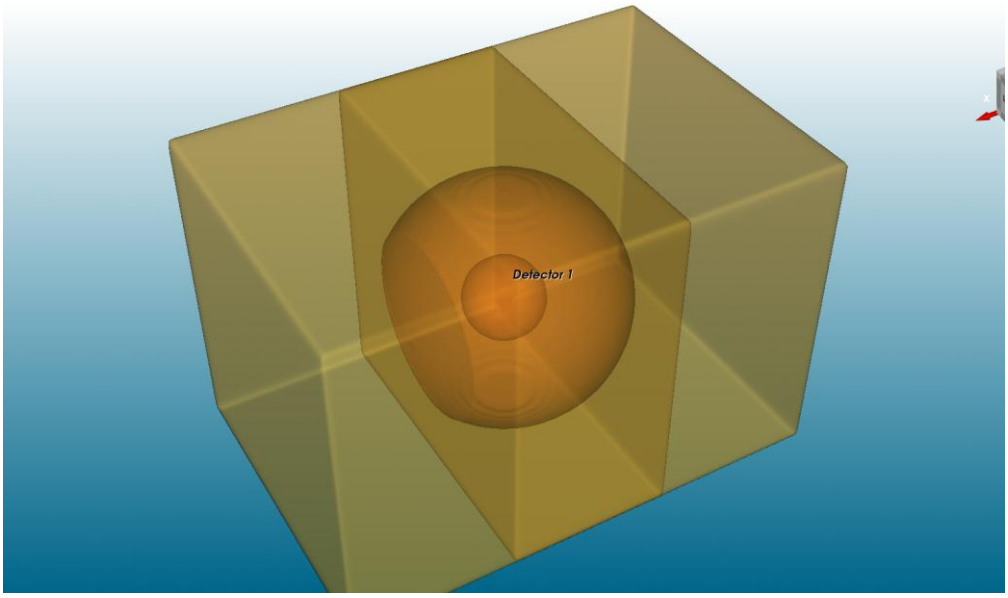
Analytical Formula: $(\pi \times h^2 \times (3R-h)) / 240$ (h = height of capped sphere, R = sphere radius)

Coverage Results

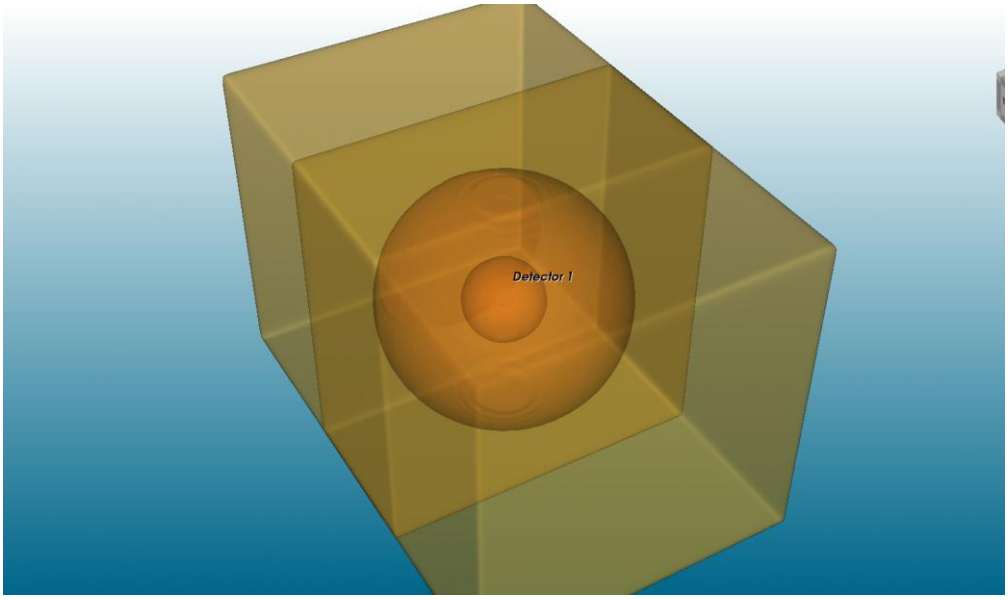
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	20.45	20.44	0.01
Grade D	1ooN	0.81	0.82	0.01



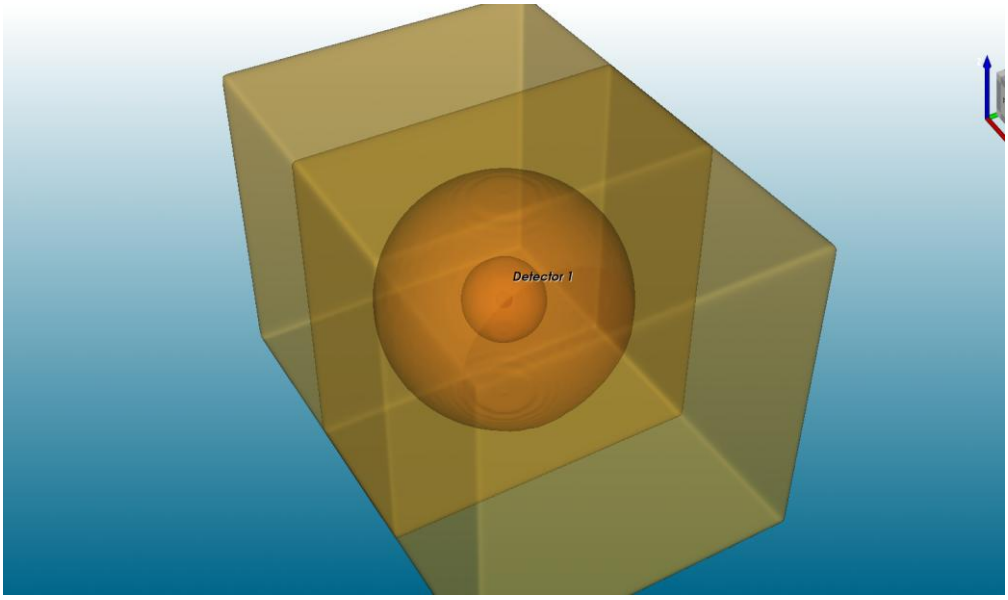
View 1



View 2



View 3



View 4

5.3.13 Two grades separated by 2m distance along with a PGD placed in between the two grades. The same detector's FOI is automatically treated differently in the two grades.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

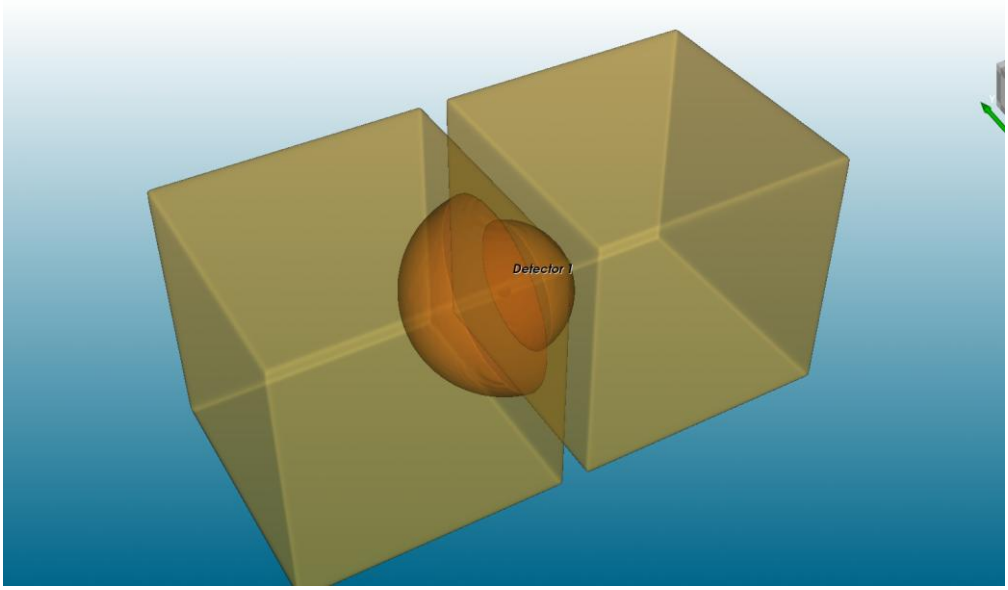
Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade C - 15 m Grade D - 10 m

Analytical Formula: $(\pi \times h^2 \times (3R-h)) / 240$ (h = height of capped sphere, R = sphere radius)

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	8.84	8.85	0.01
Grade D	1ooN	2.3	2.3	0.00



View 1

5.3.14 One PGD inside each cylindrical grade with its FOI completely inside the relelvant grade.

Risk Grades

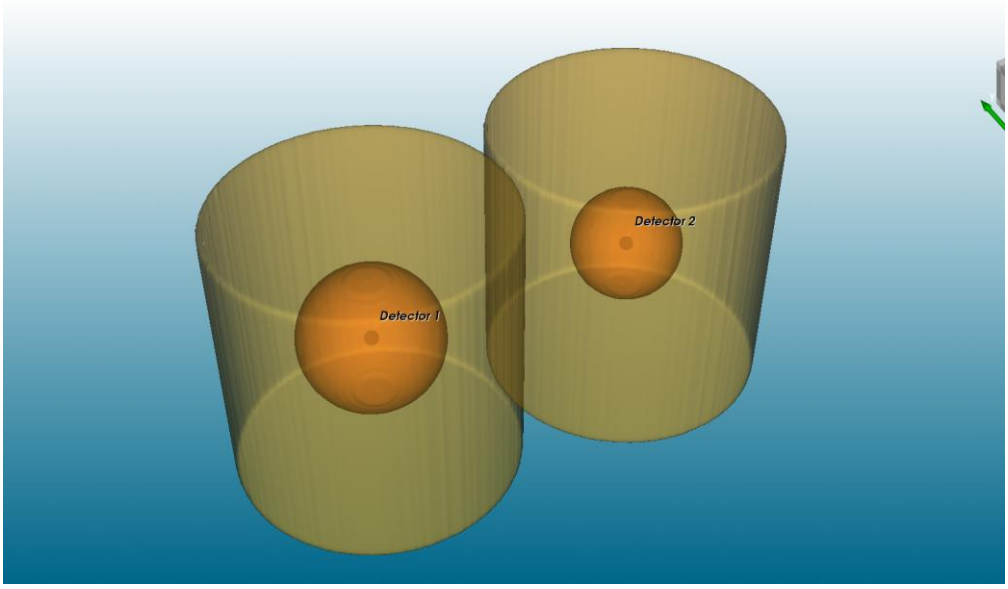
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade D
Cylinder	Radius 10 m, Height 20 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade D - 10 m Grade B - 8 m
Point Gas Detector (PGD)	H2S	Grade D - 10 m Grade B - 8 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	8.33	8.33	0.00
Grade B	1ooN	4.27	4.26	0.01



View 1

5.4 Cross Credit Validation

5.4.1 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

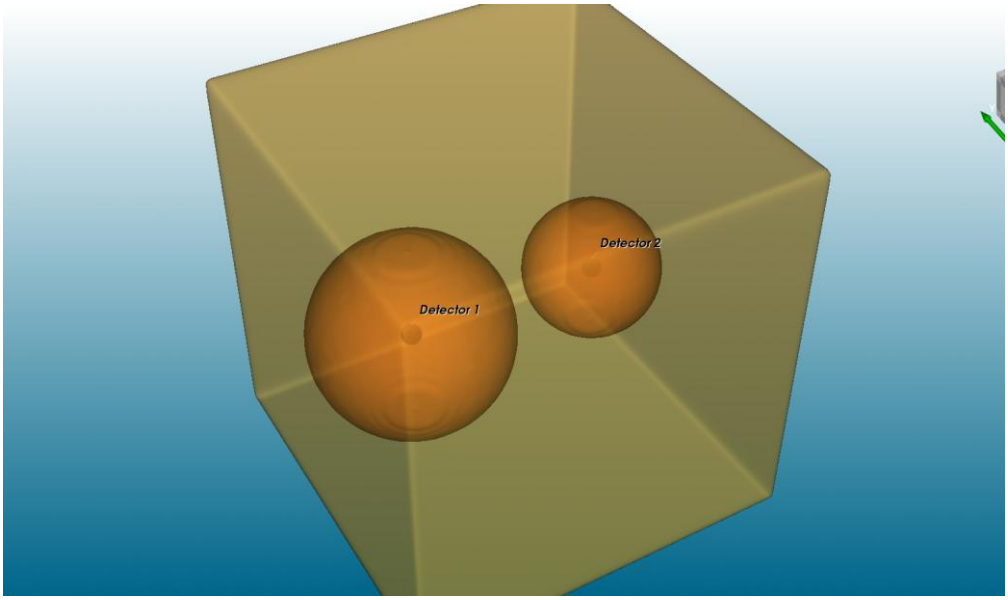
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m
Point Gas Detector (PGD)	H2S	Grade D - 7 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	8.79	8.78	0.01



View 1

5.4.2 One HC PGD and one H2S PGD with their FOI overlapping and completely inside a cubical grade. 2ooN coverage assessed.

Risk Grades

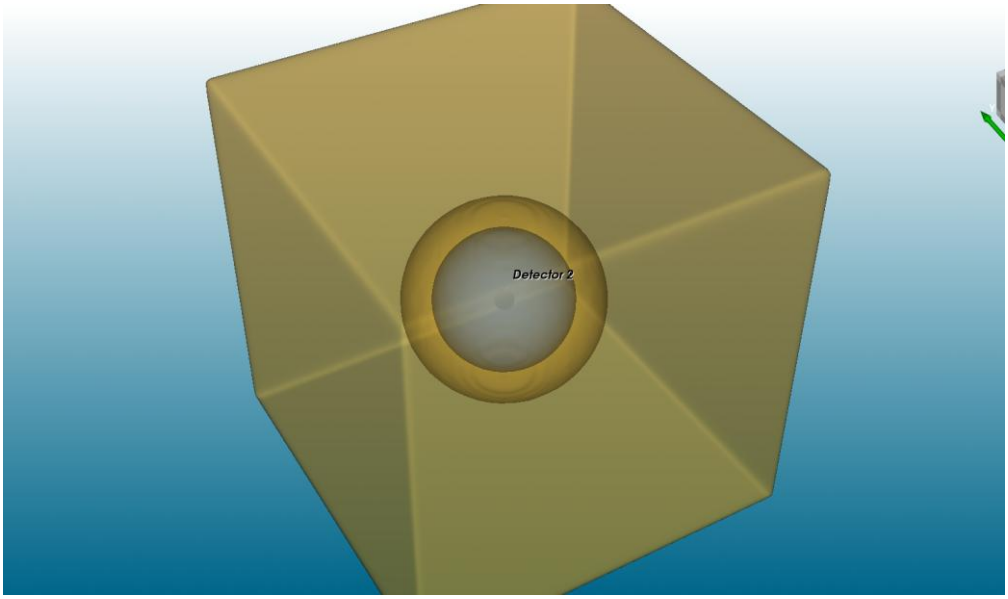
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	H2S	Grade B - 7 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	2.24	2.24	0.00



View 1

5.4.3 Three PGDs - one HC, one H2S and one H2 with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

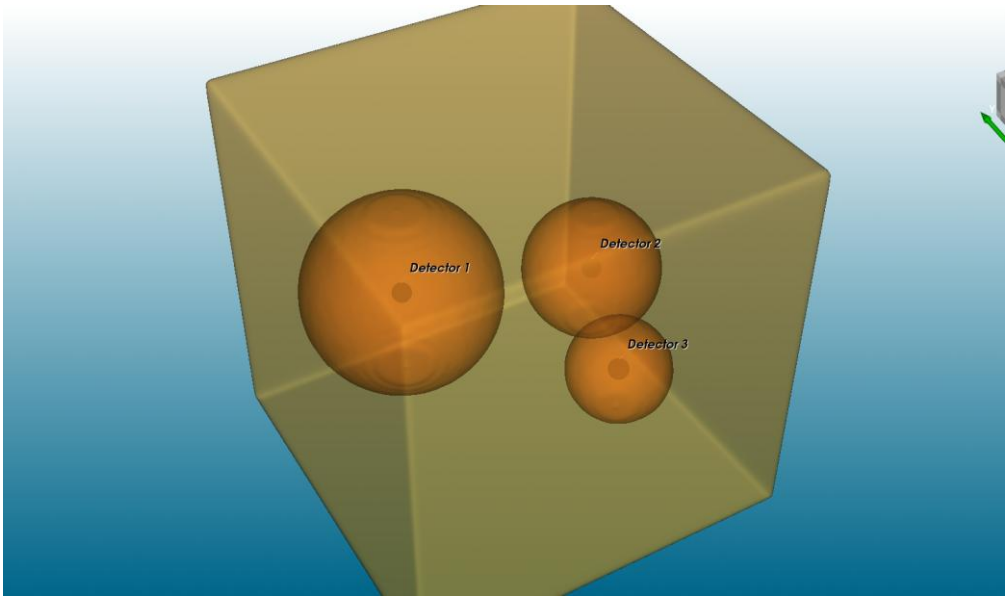
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m
Point Gas Detector (PGD)	H2S	Grade D - 7 m
Point Gas Detector (PGD)	H2	Grade D - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	9.61	9.59	0.02



View 1

5.4.4 Three PGDs - one HC, one H2S and one H2 with their FOI completely inside a cubical grade. FOI of H2S and H2 PGDs overlap. 2ooN coverage assessed.

Risk Grades

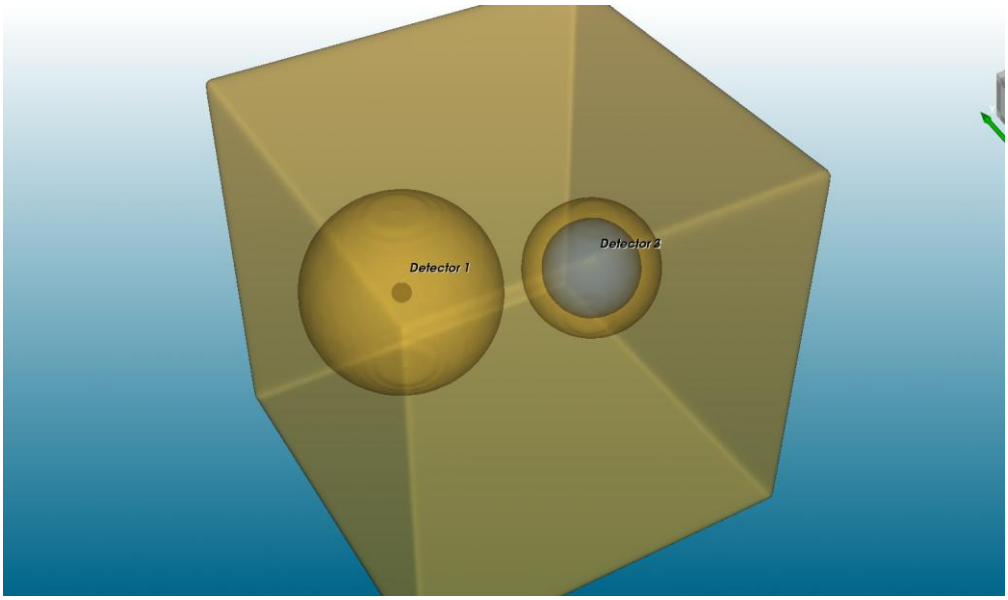
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - 10 m
Point Gas Detector (PGD)	H2S	Grade A - 7 m
Point Gas Detector (PGD)	H2	Grade A - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	2ooN	0.82	0.82	0.00



View 1

5.4.5 Three PGDs - one HC, one H2S and one H2 with their FOI overlapping and completely inside a cubical grade. 3ooN coverage assessed.

Risk Grades

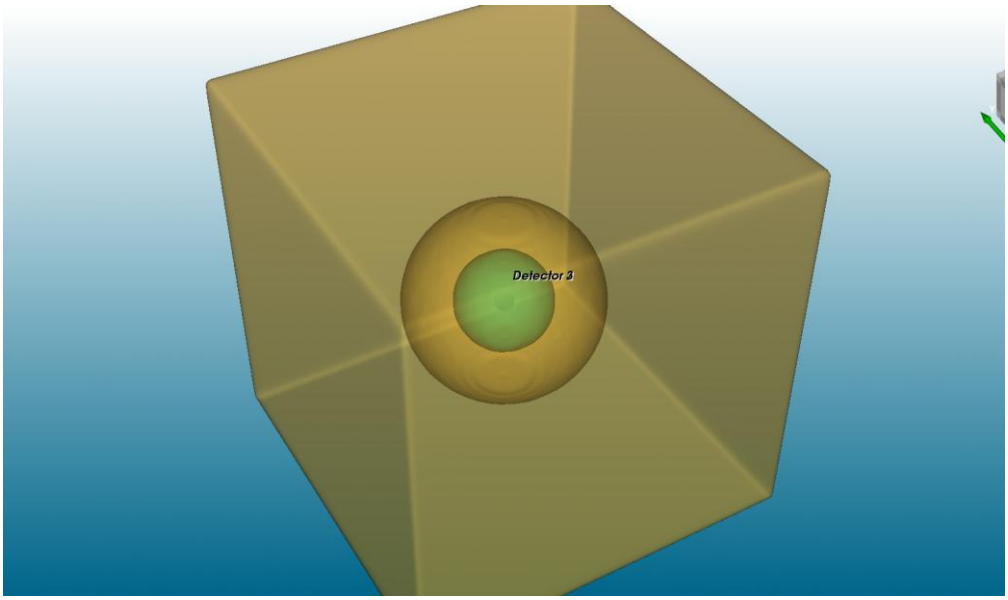
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	H2S	Grade B - 7 m
Point Gas Detector (PGD)	H2	Grade B - 5 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	3ooN	0.82	0.82	0.00



View 1

5.4.6 Four PGDs - three HC and one H2S with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

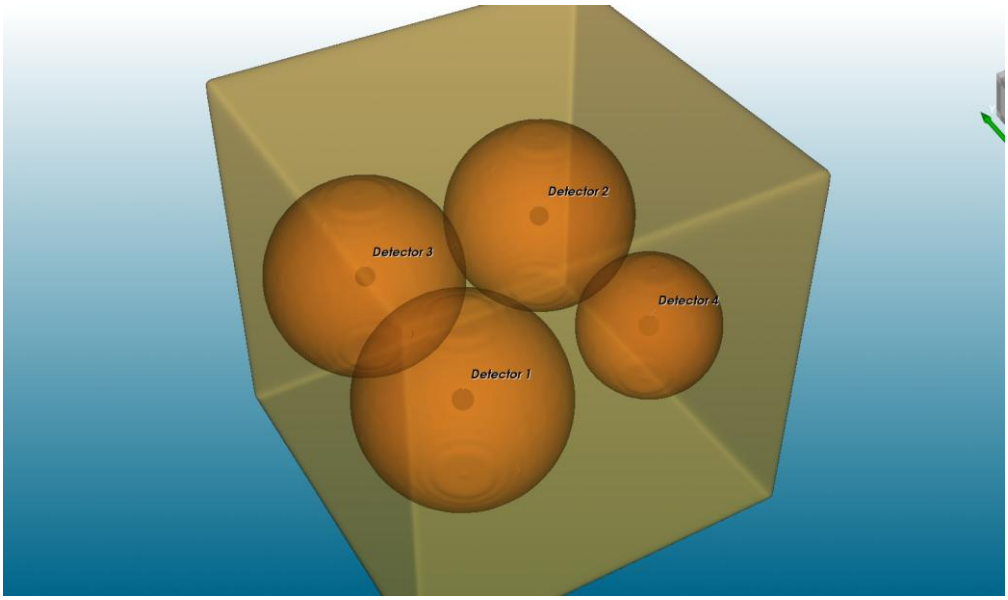
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	H2S	Grade B - 7 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	21.88	21.84	0.04



View 1

5.4.7 Four PGDs - one HC and three H2S with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

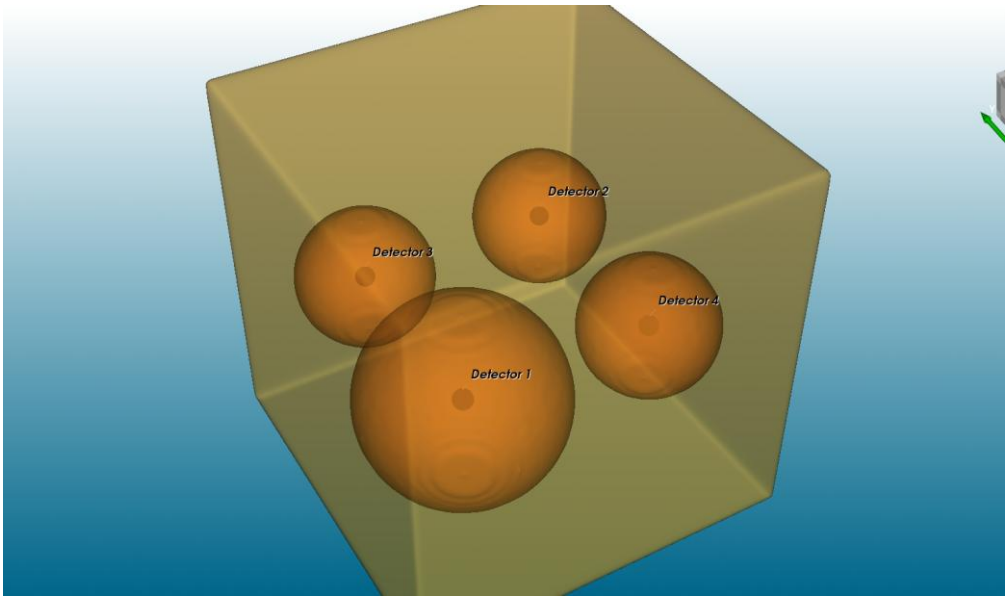
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - 10 m
Point Gas Detector (PGD)	H2S	Grade A - 7 m
Point Gas Detector (PGD)	H2S	Grade A - 7 m
Point Gas Detector (PGD)	H2S	Grade A - 7 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	13.28	13.26	0.02



View 1

5.4.8 Two OPGDs - one HC and one H2S with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

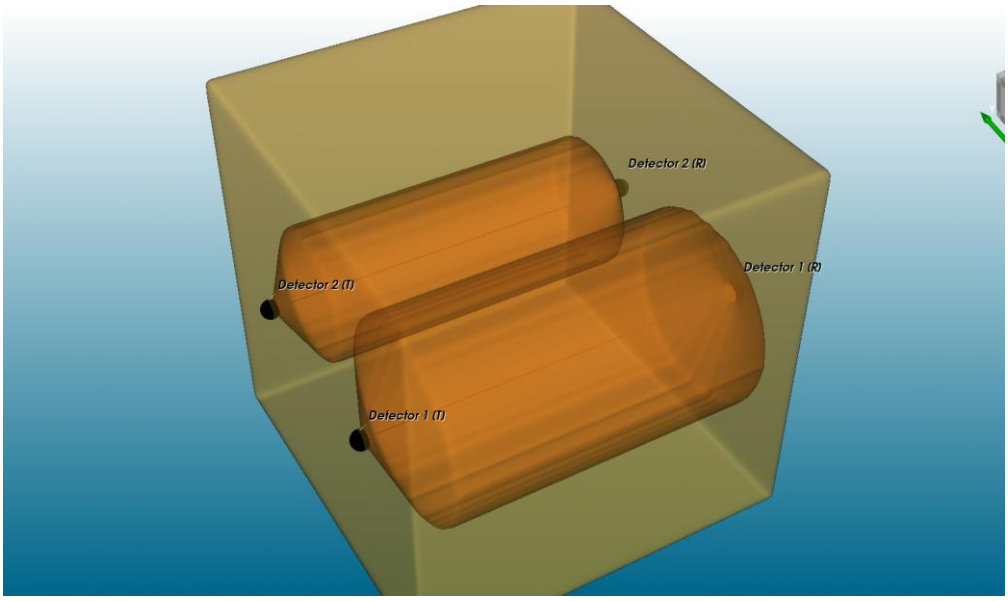
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade B - 10 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - 7 m

Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	25.36	25.2	0.16



View 1

5.5 Validation with Geometry

5.5.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside a cubical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

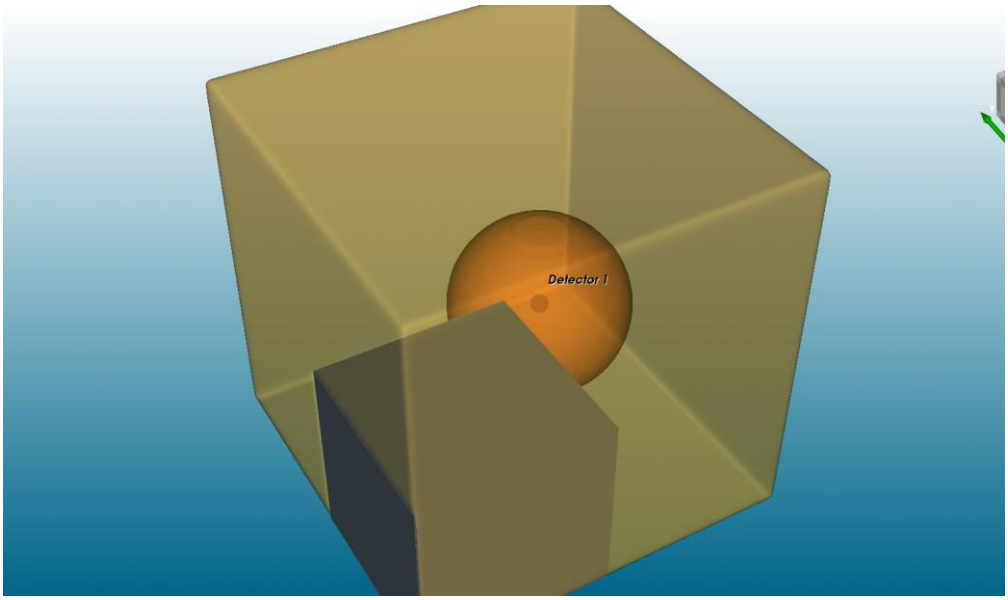
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

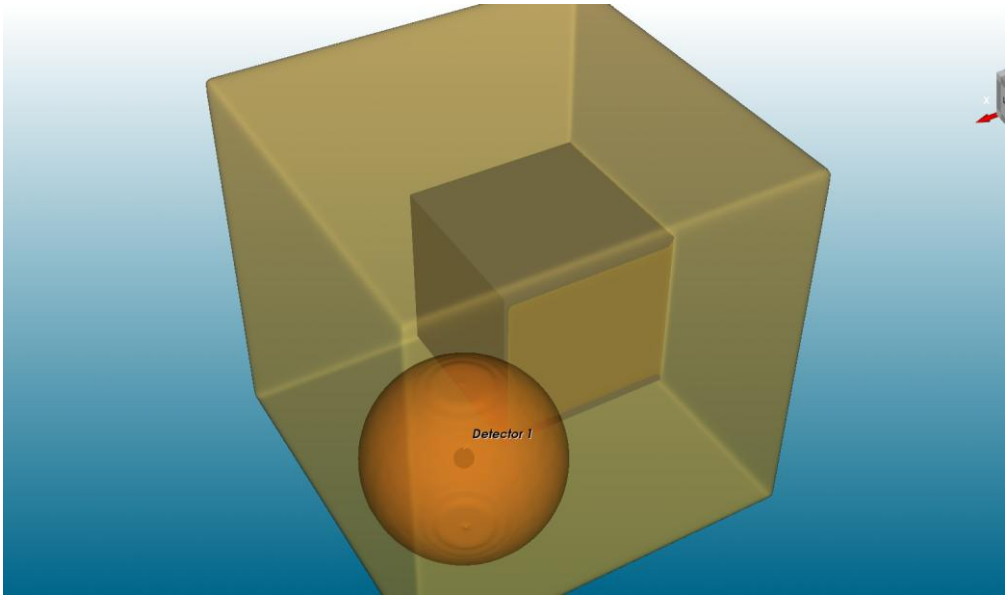
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - 10 m

Coverage Results

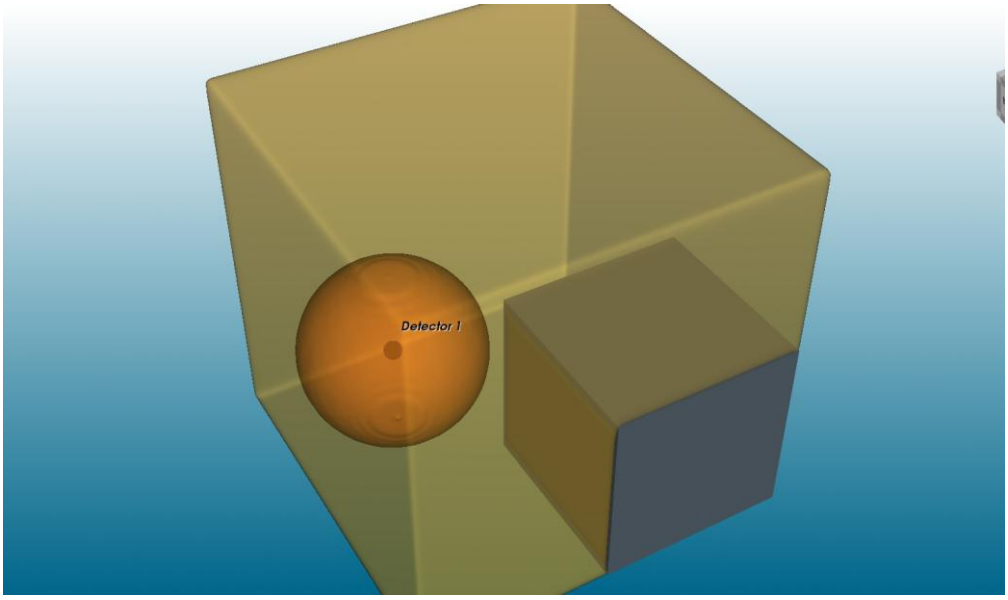
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	7.48	7.44	0.04



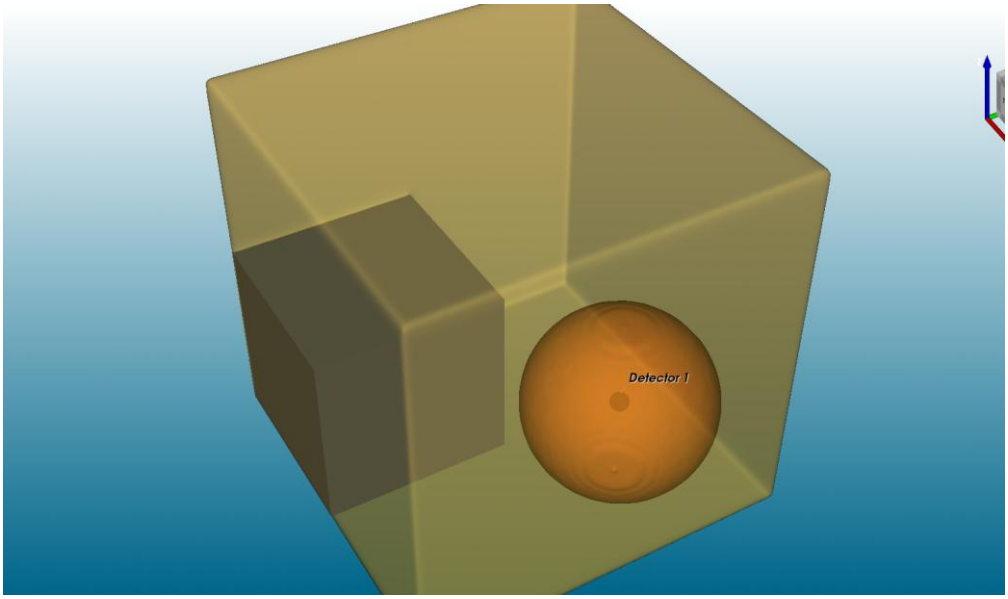
View 1



View 2



View 3



View 4

5.5.2 One PGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

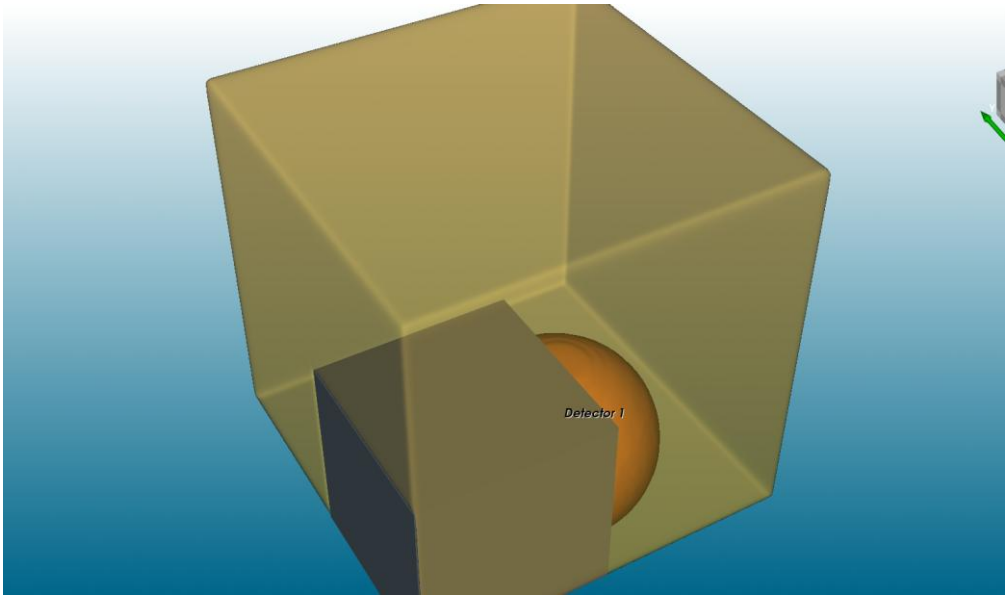
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

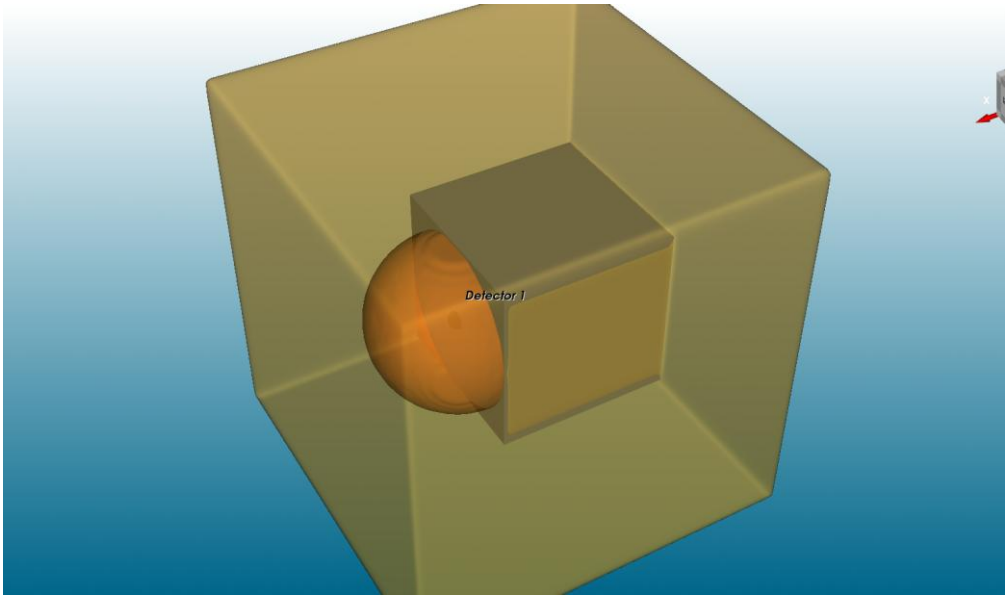
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m

Coverage Results

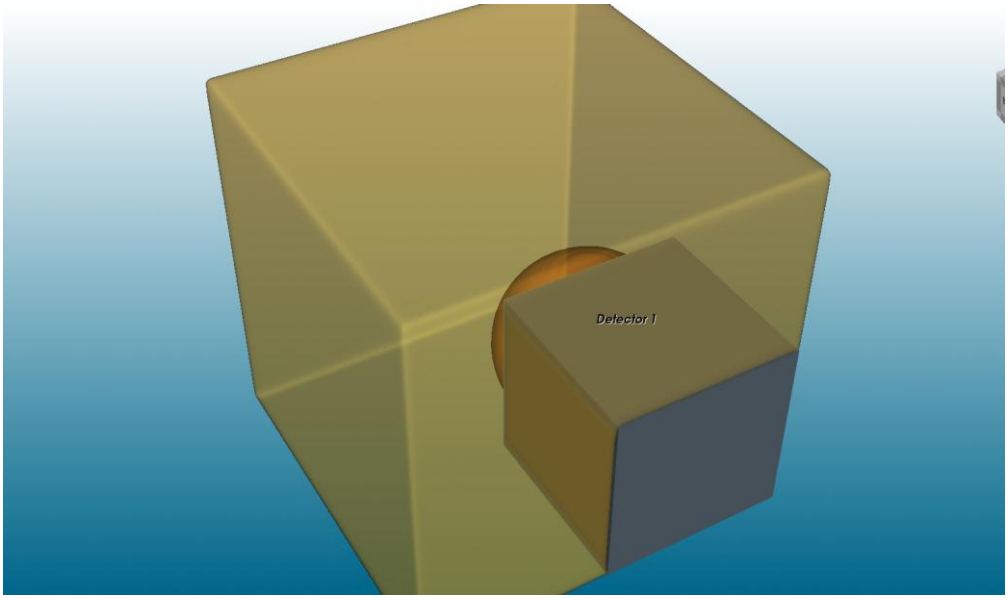
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	3.74	3.78	0.04



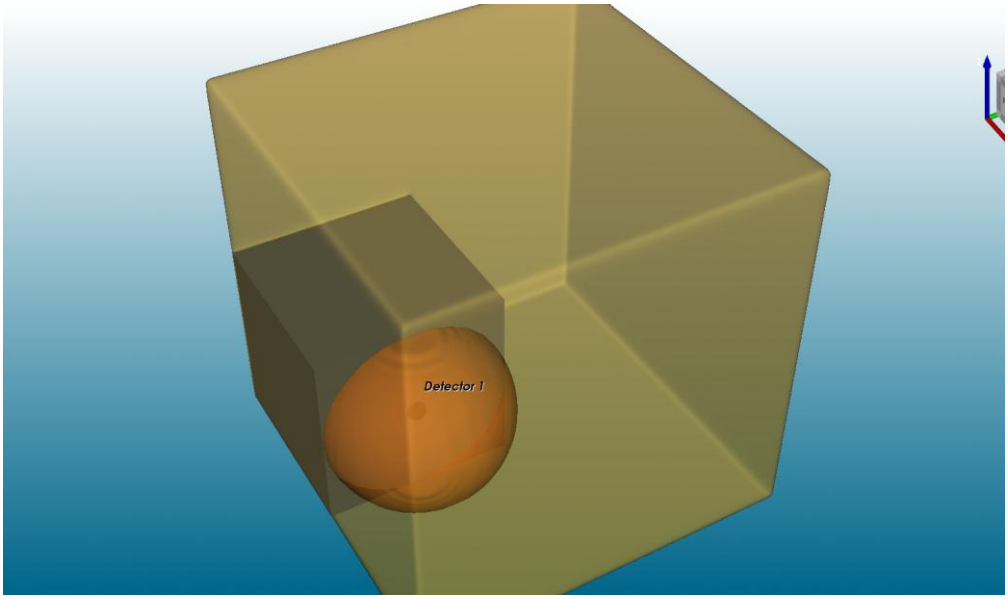
View 1



View 2



View 3



View 4

5.5.3 One PGD with its FOI completely inside a cylindrical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

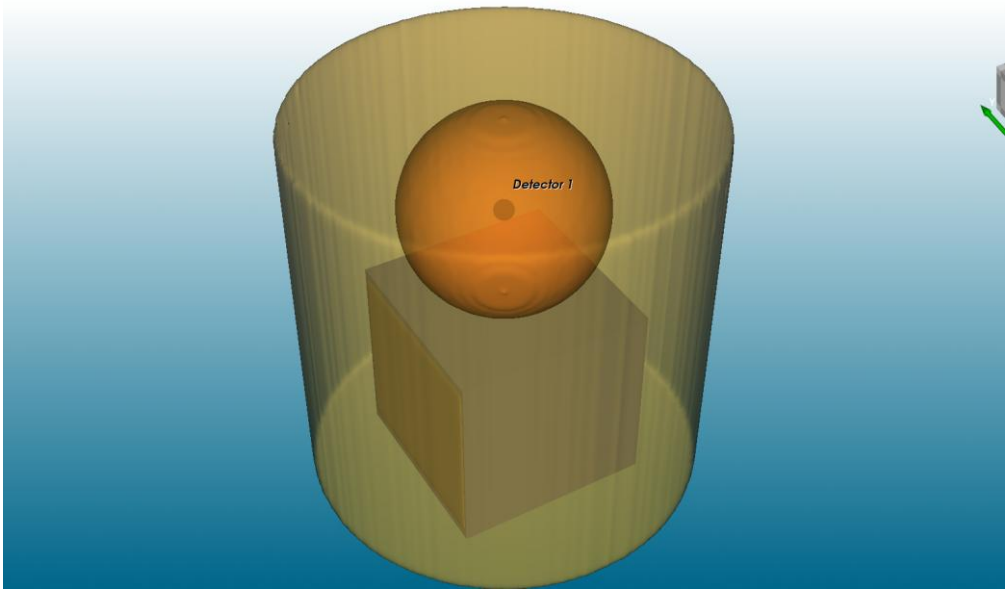
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade D

Gas Detectors

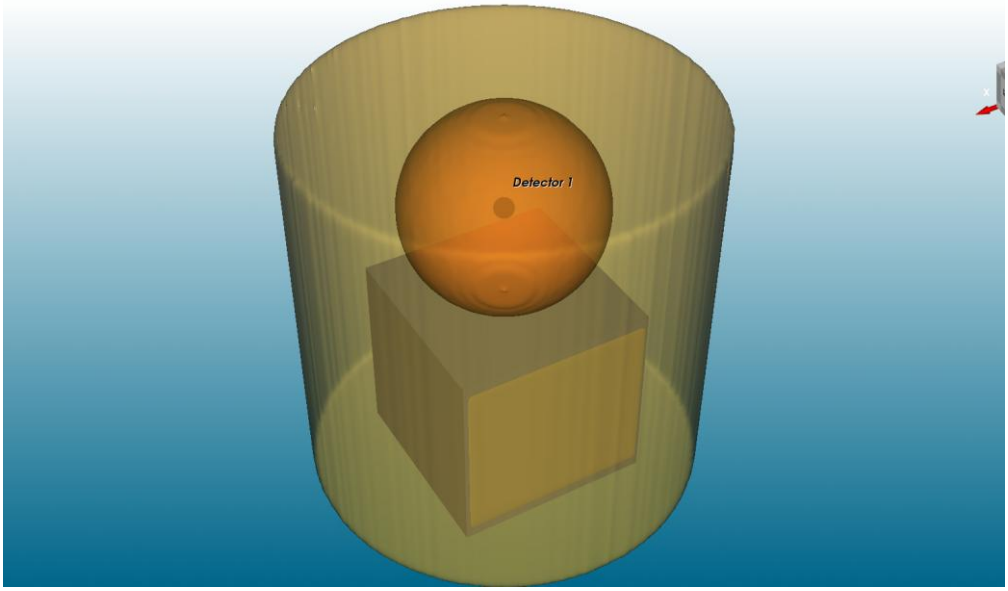
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m

Coverage Results

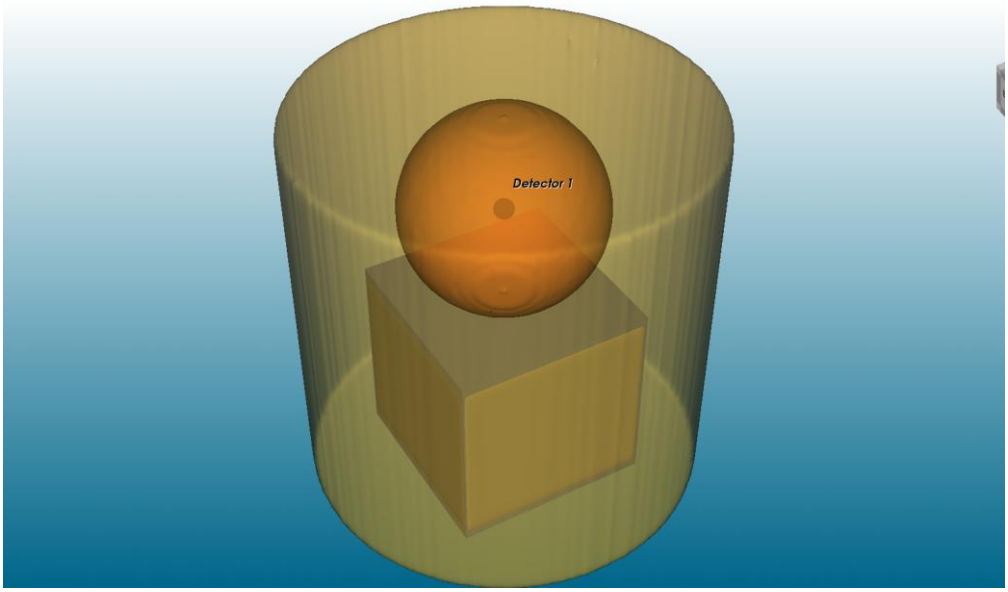
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	9.91	9.86	0.05



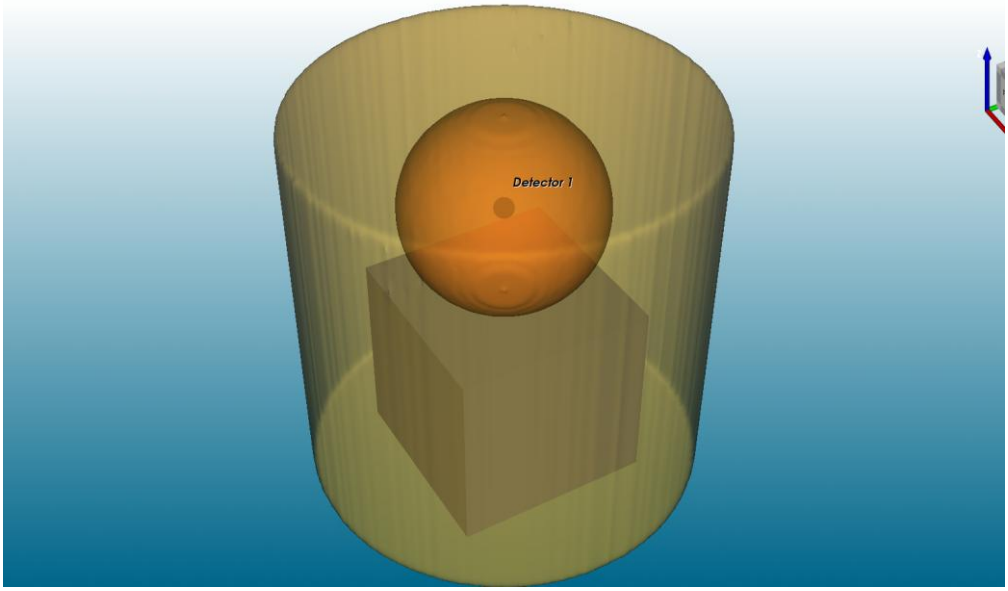
View 1



View 2



View 3



View 4

5.5.4 One Open Path Gas Detector (OPGD) with its Field of Influence (FOI) completely inside a cubical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

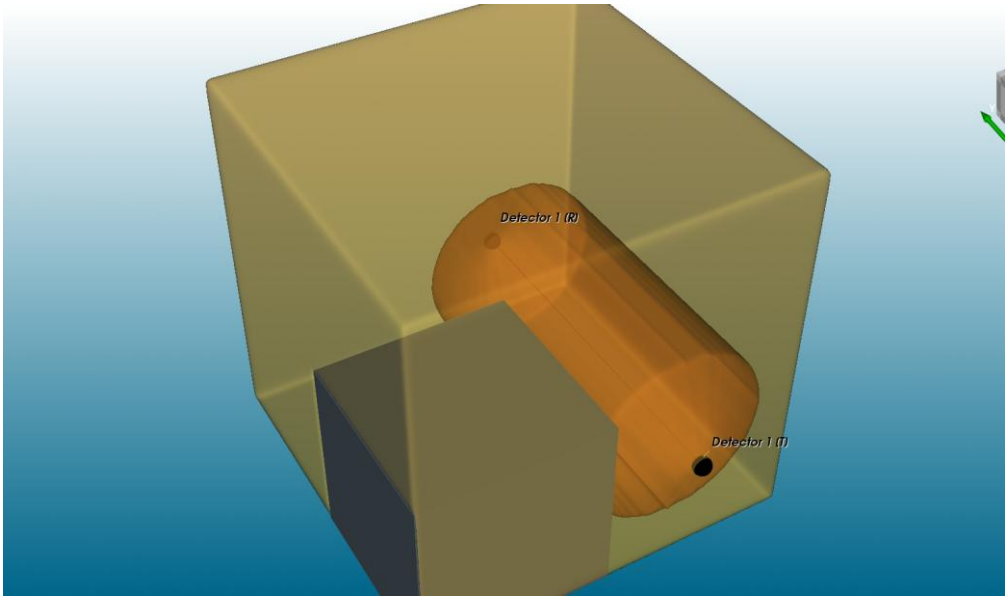
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

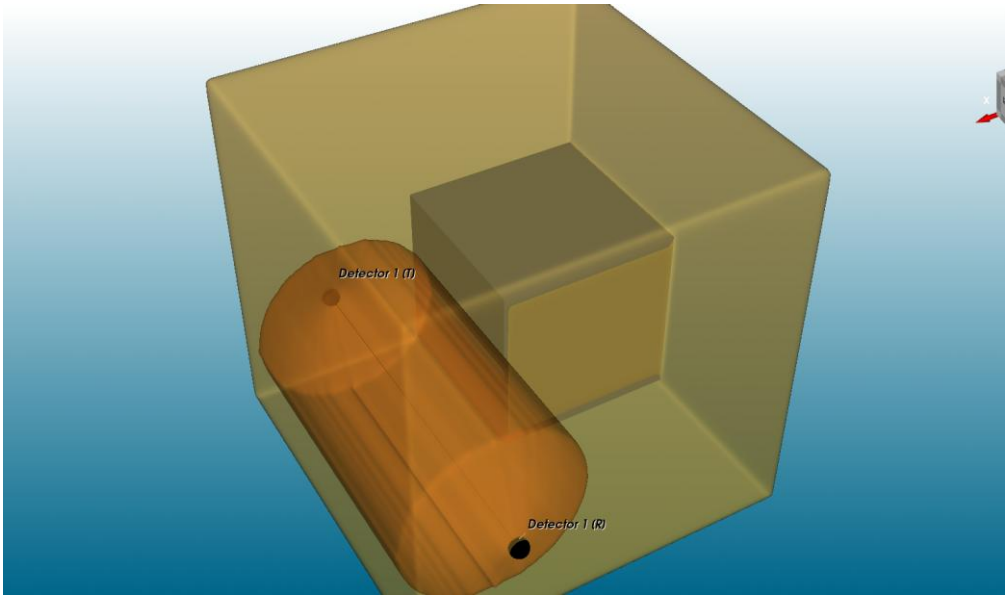
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - 10 m

Coverage Results

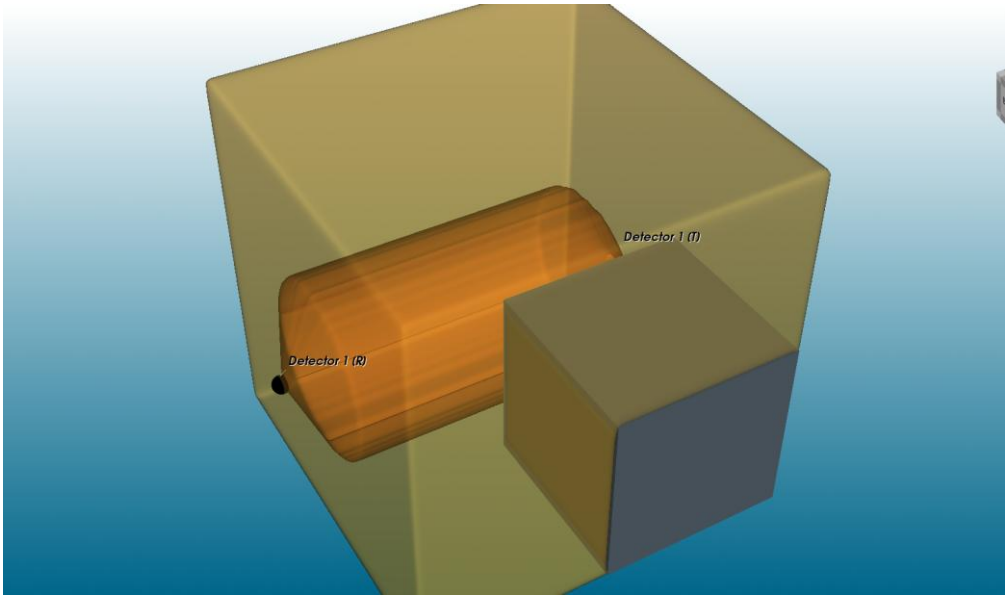
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	19.45	19.26	0.19



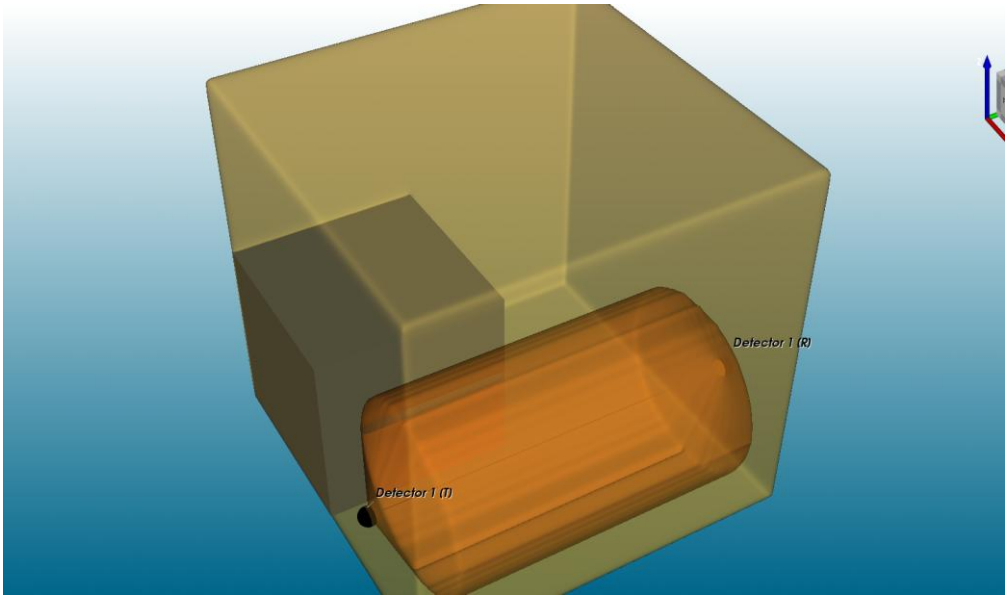
View 1



View 2



View 3



View 4

5.5.5 One OPGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

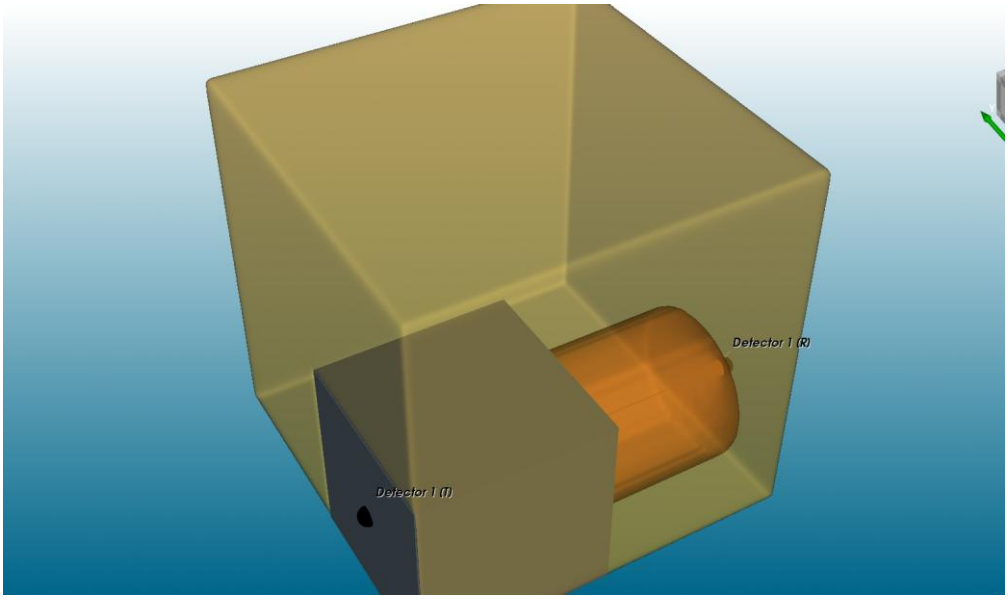
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 8 m

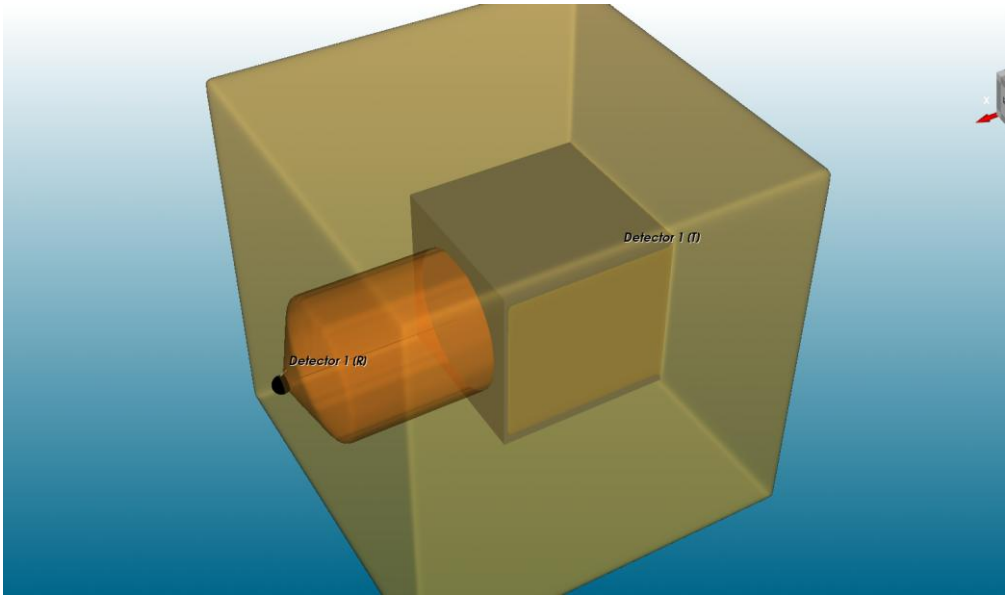
Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	6.22	6.2	0.02

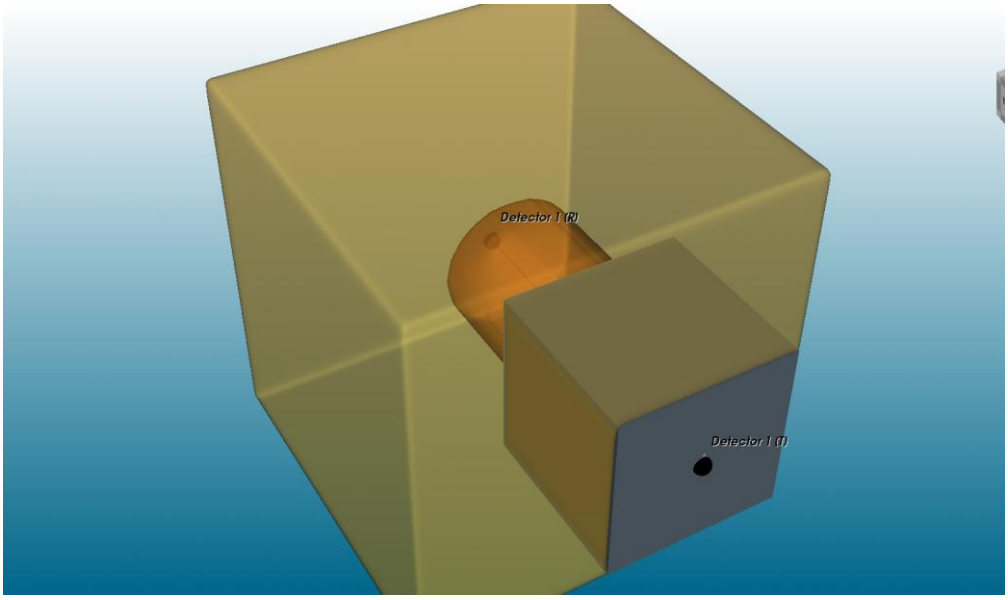
Note: 'Half inside' OPGD: line passes straight through the cube (y matches the cube's own y-centre) rather than sitting offset on its face — that's how the reference project did it for a line, vs the point case which sits centred exactly on the face.



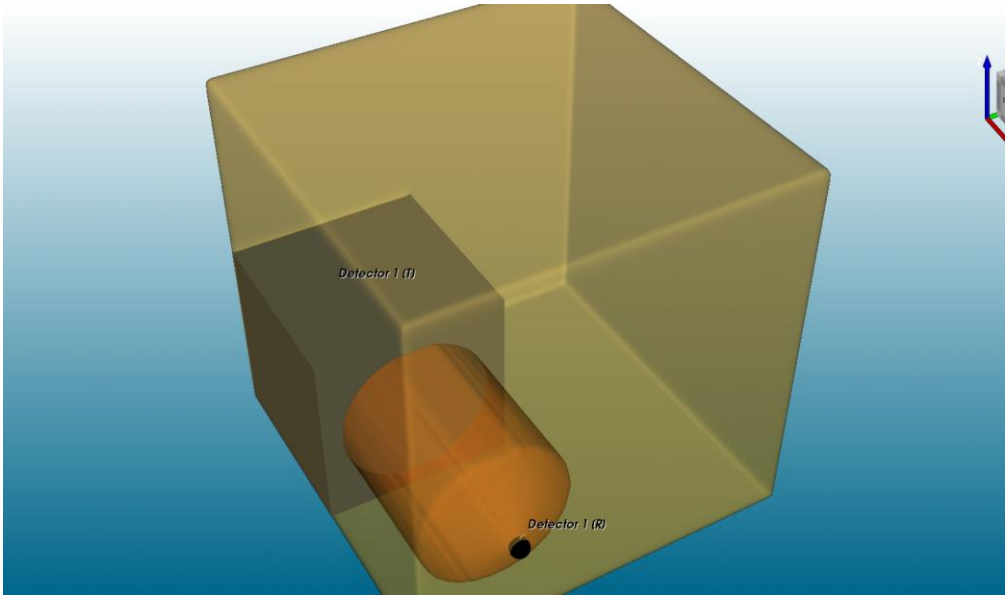
View 1



View 2



View 3



View 4

5.5.6 One OPGD with its FOI completely inside a cylindrical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

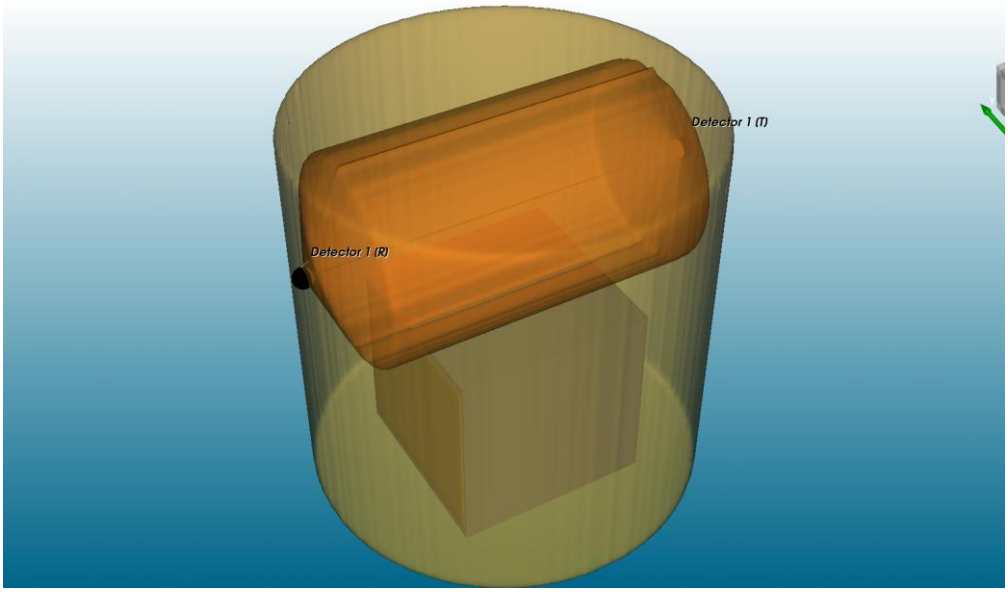
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade C

Gas Detectors

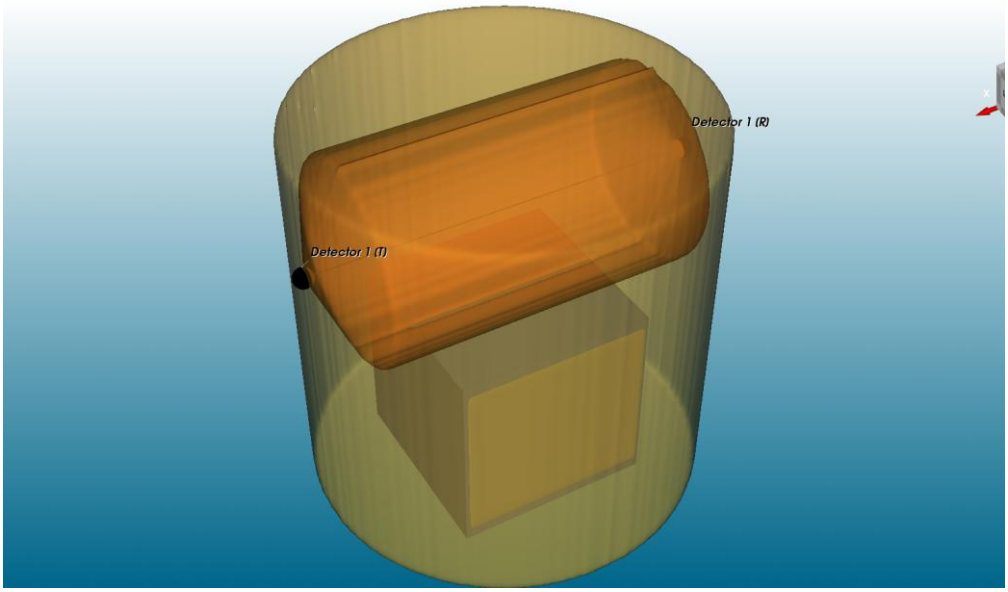
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m

Coverage Results

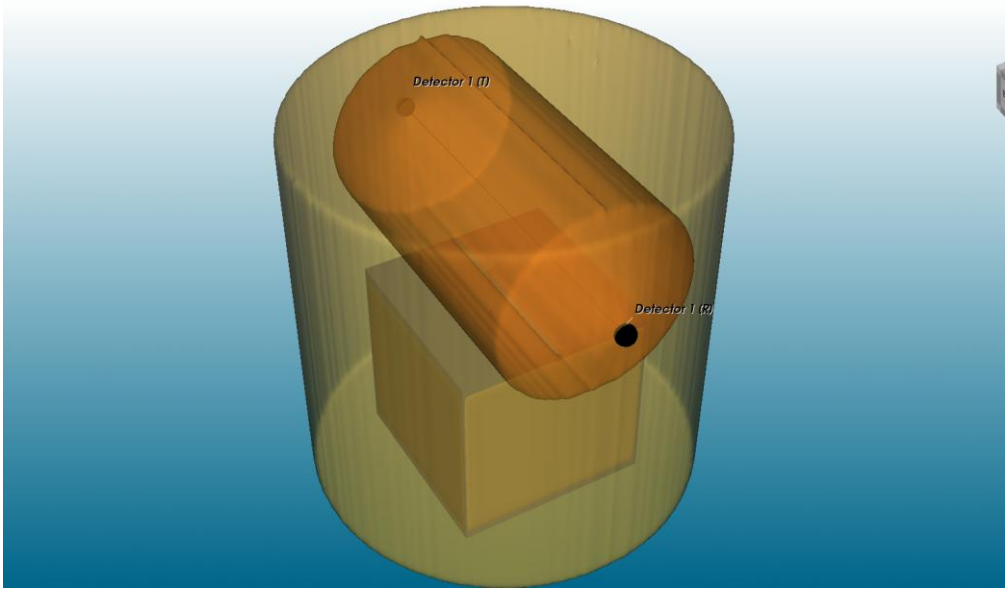
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	25.77	25.54	0.23



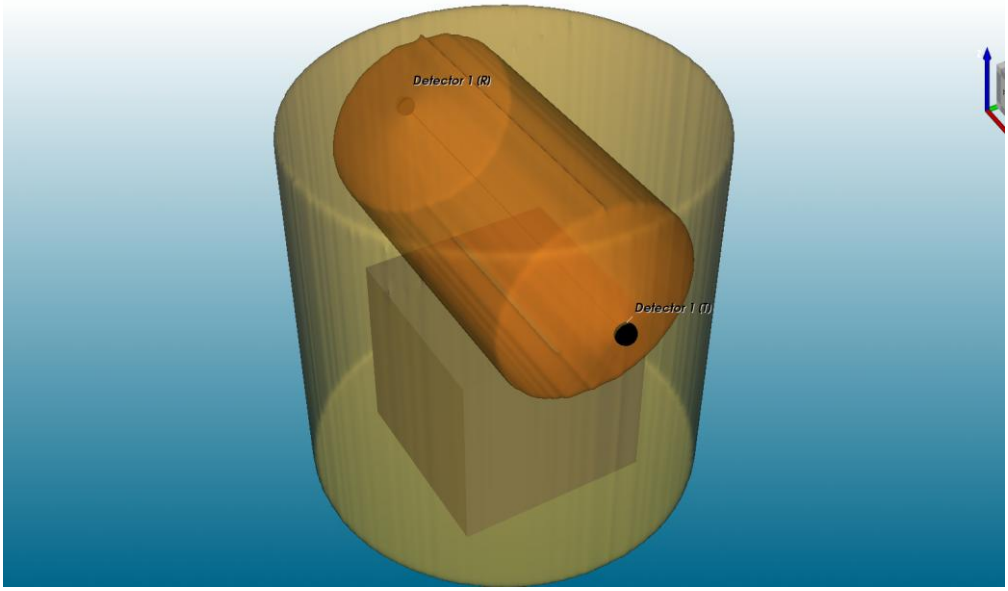
View 1



View 2



View 3



View 4

5.5.7 One PGD with its FOI completely inside a cubical grade but outside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

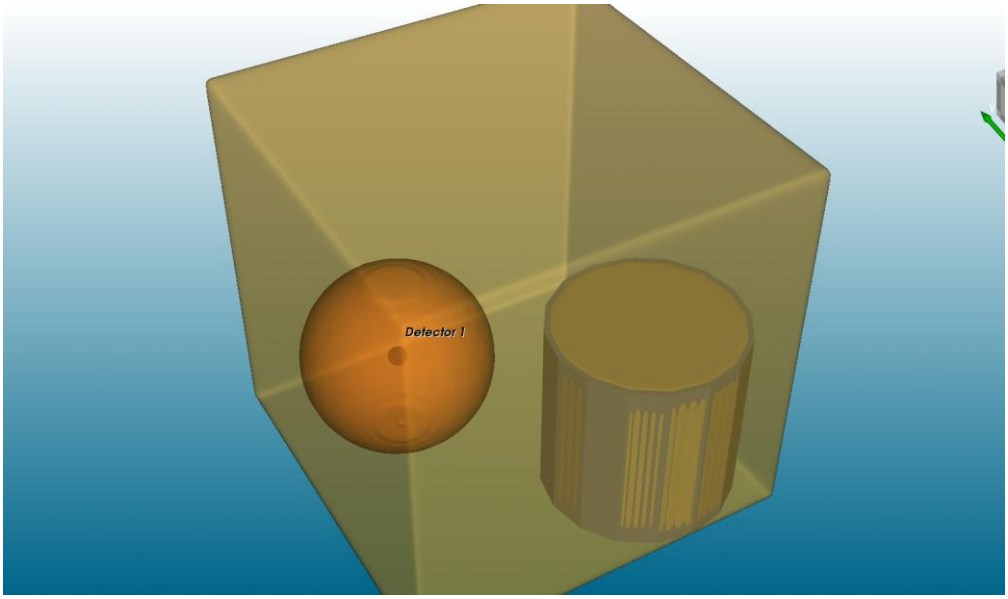
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

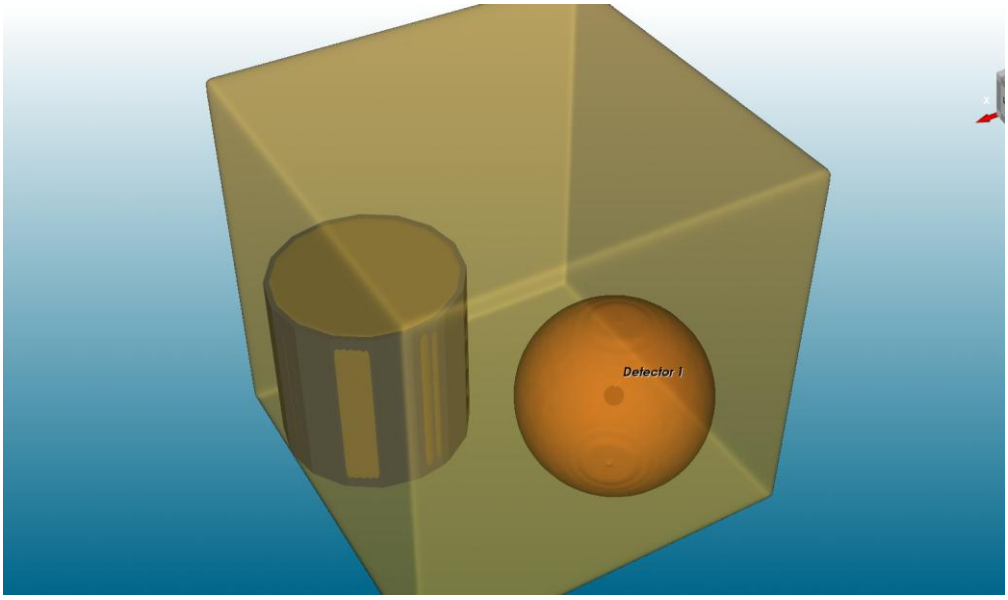
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m

Coverage Results

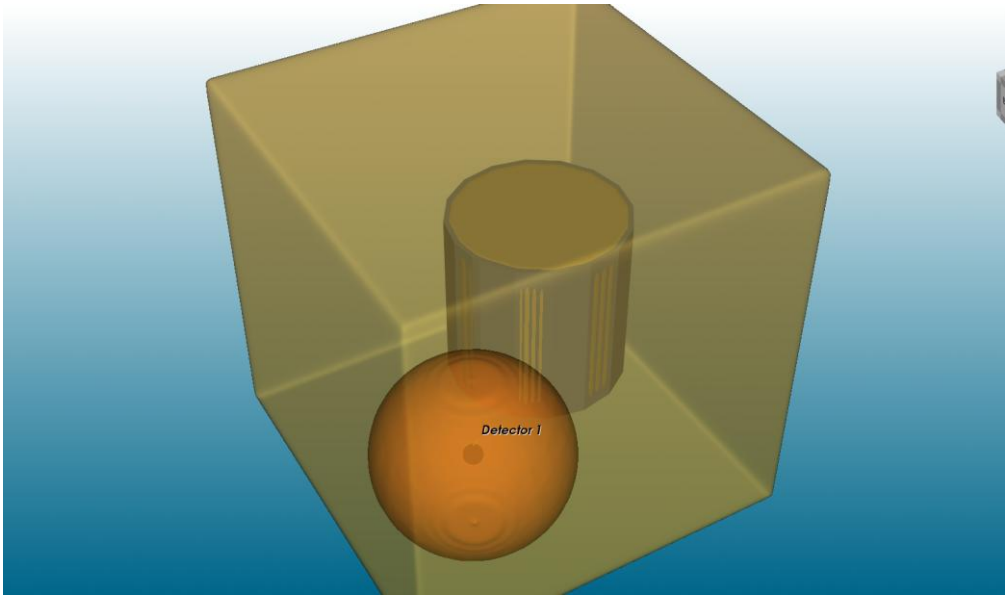
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	7.26	7.23	0.03



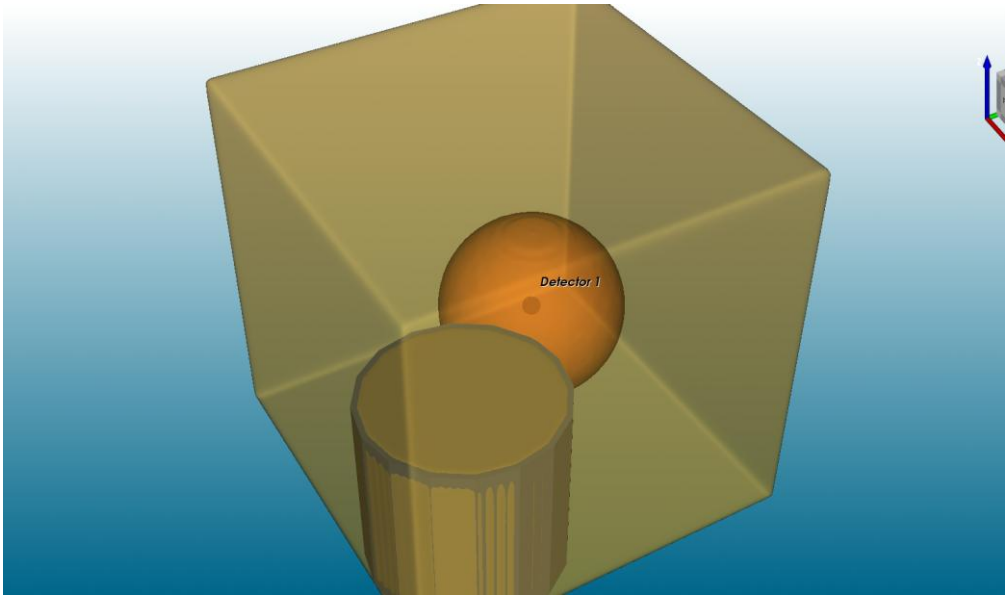
View 1



View 2



View 3



View 4

5.5.8 One PGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

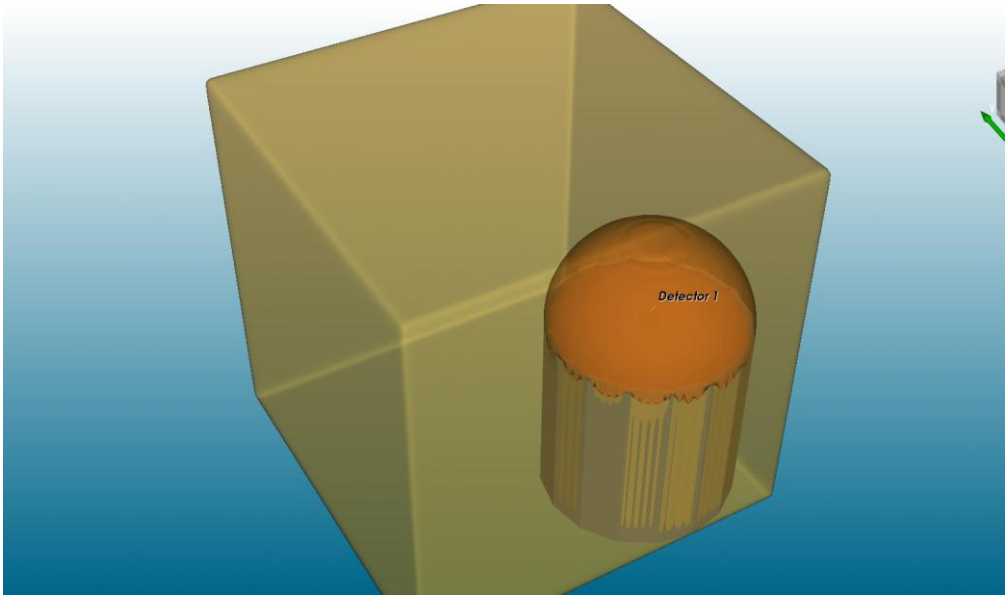
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

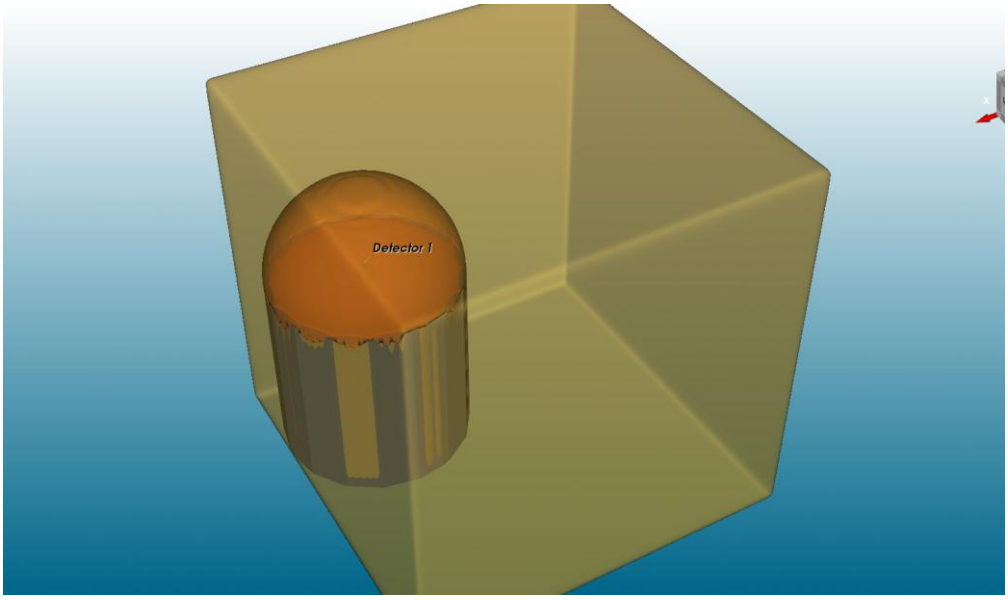
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - 10 m

Coverage Results

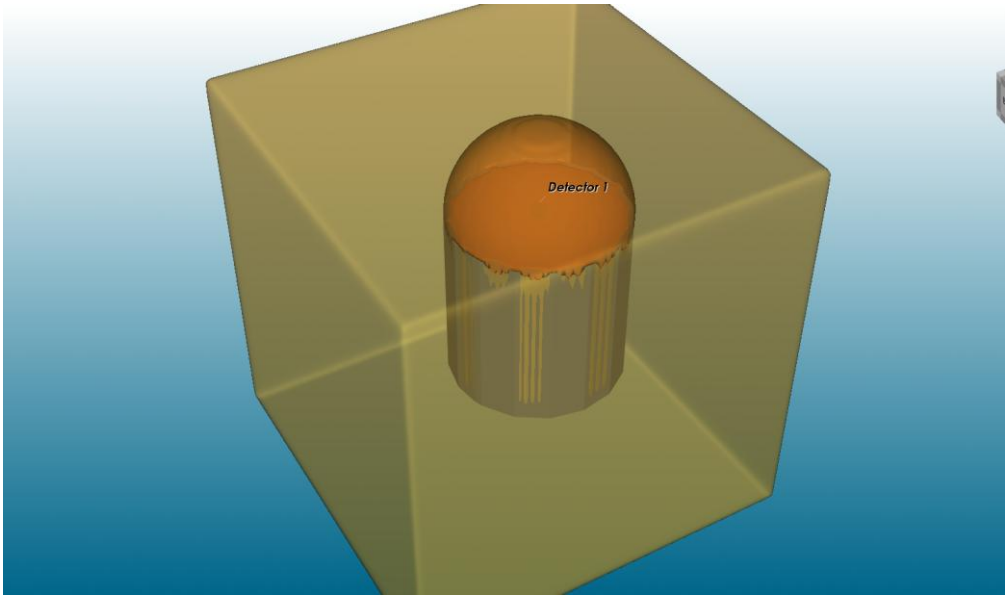
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	3.63	3.71	0.08



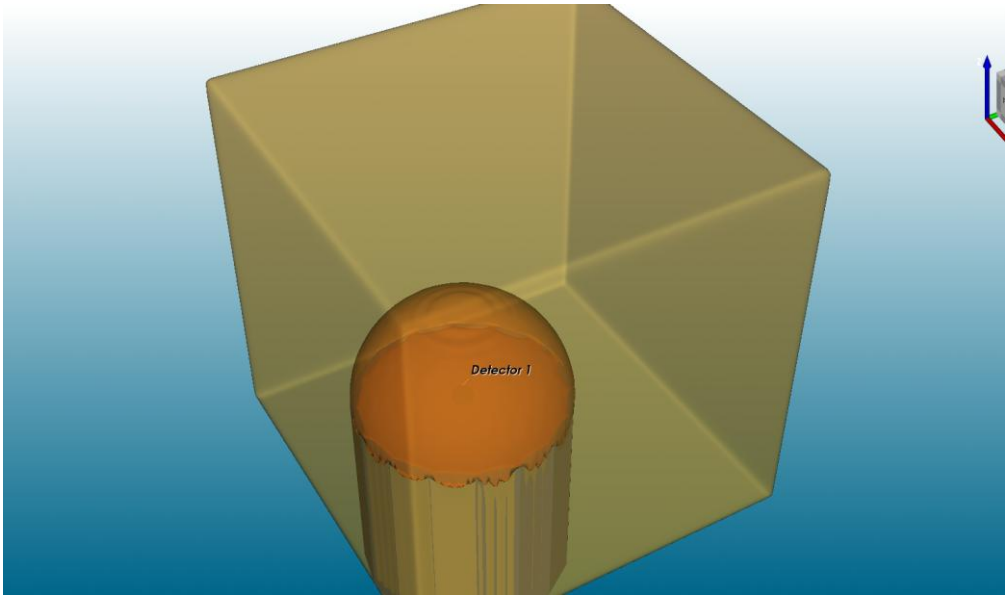
View 1



View 2



View 3



View 4

5.5.9 One OPGD with its FOI completely inside a cubical grade but outside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

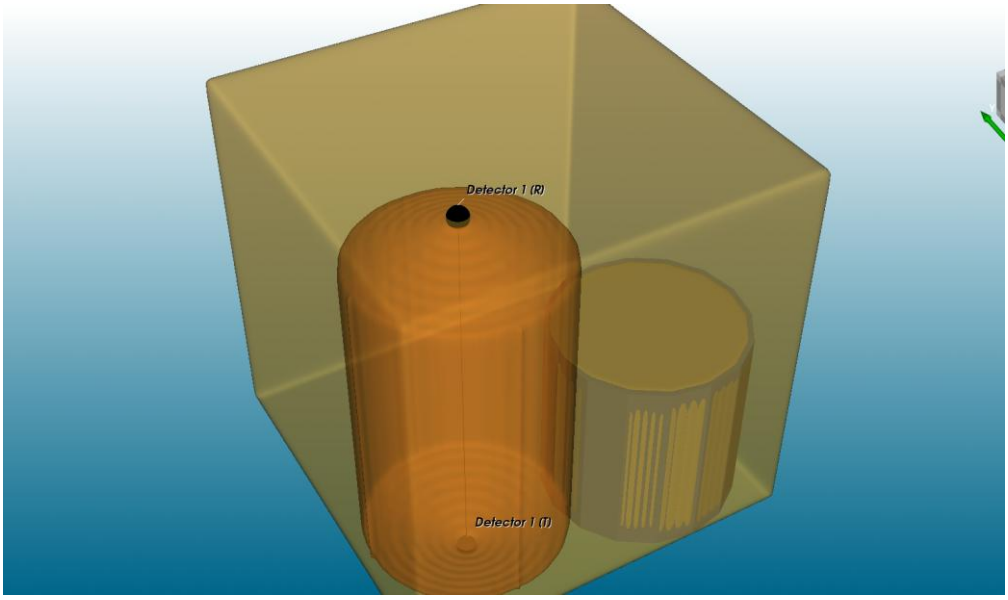
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

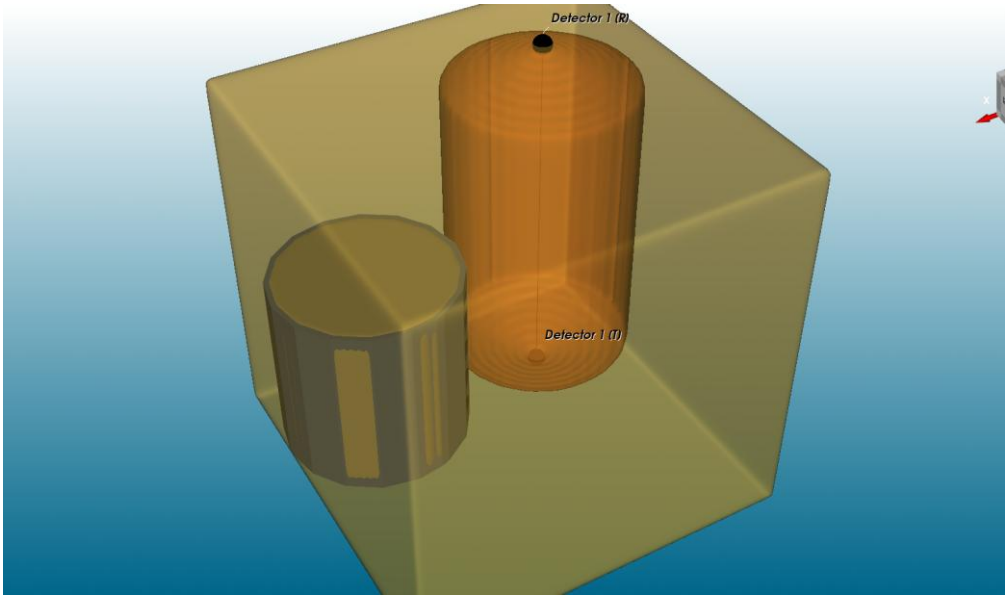
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m

Coverage Results

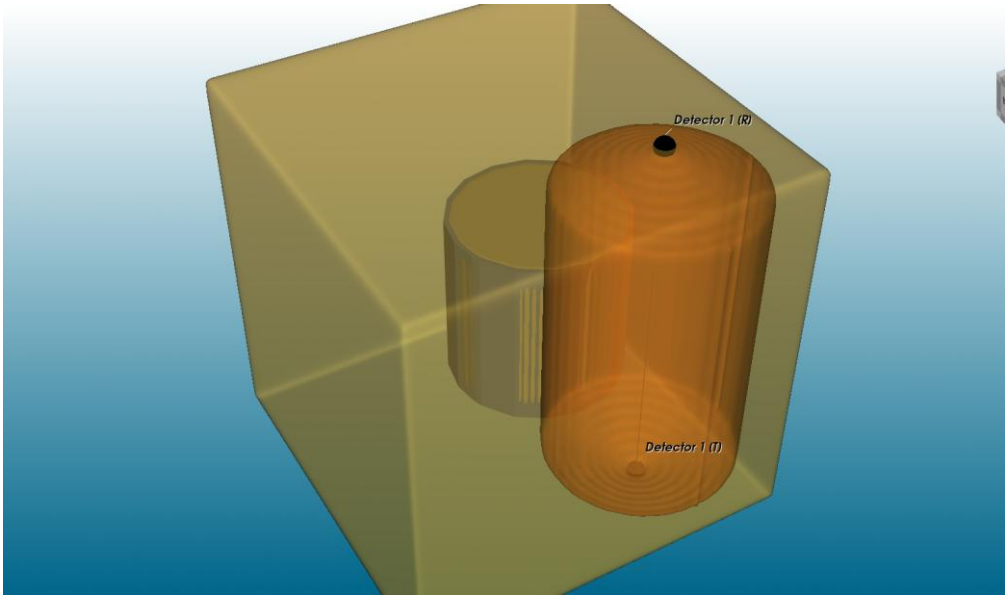
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	18.87	18.8	0.07



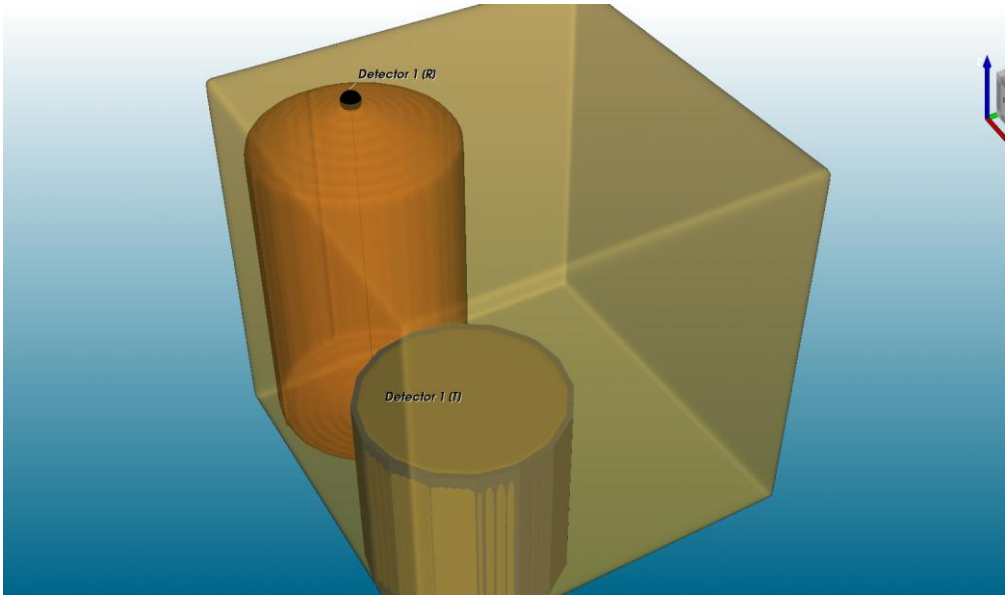
View 1



View 2



View 3



View 4

5.5.10 One OPGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

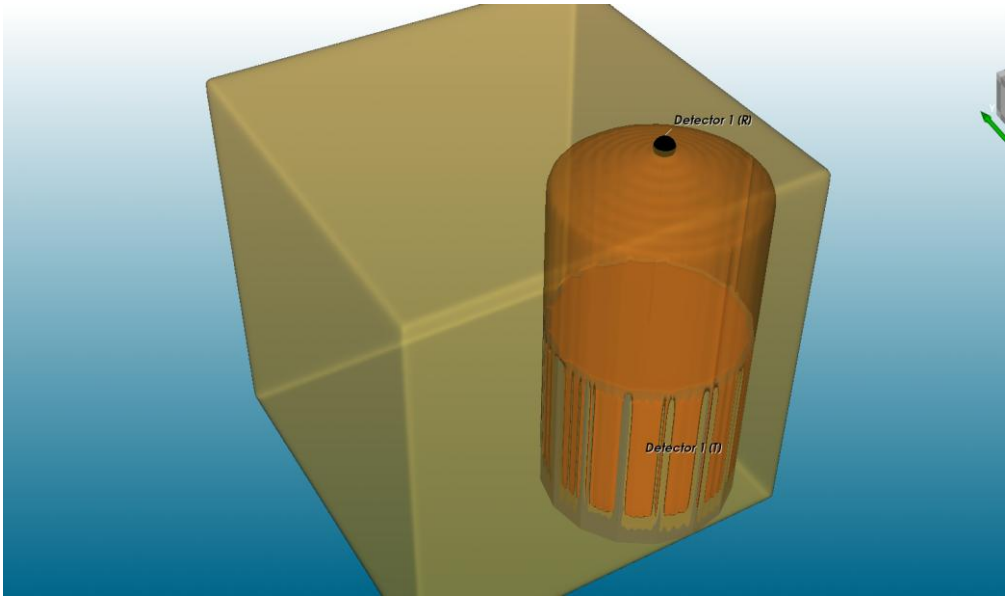
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

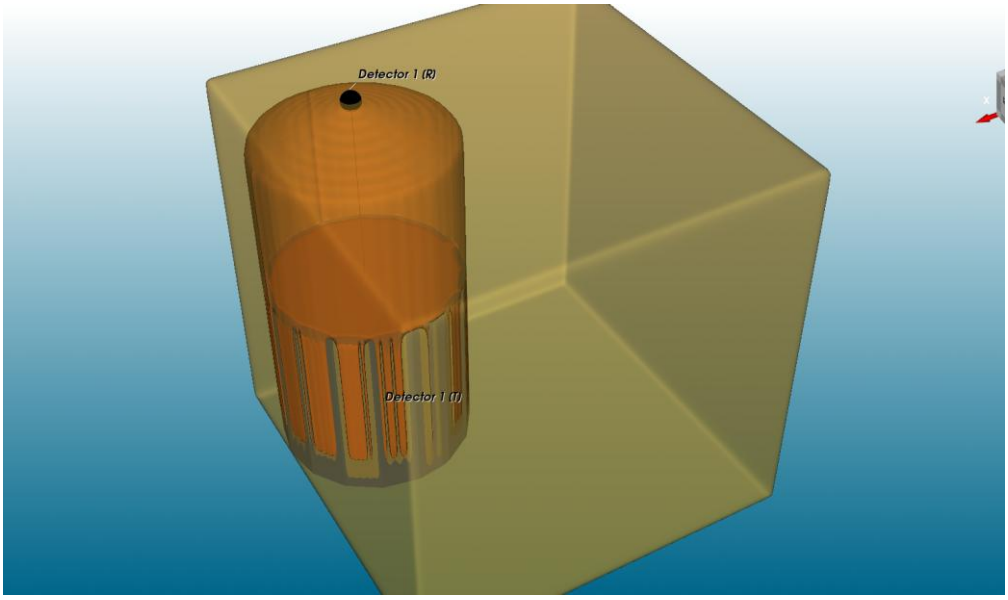
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - 10 m

Coverage Results

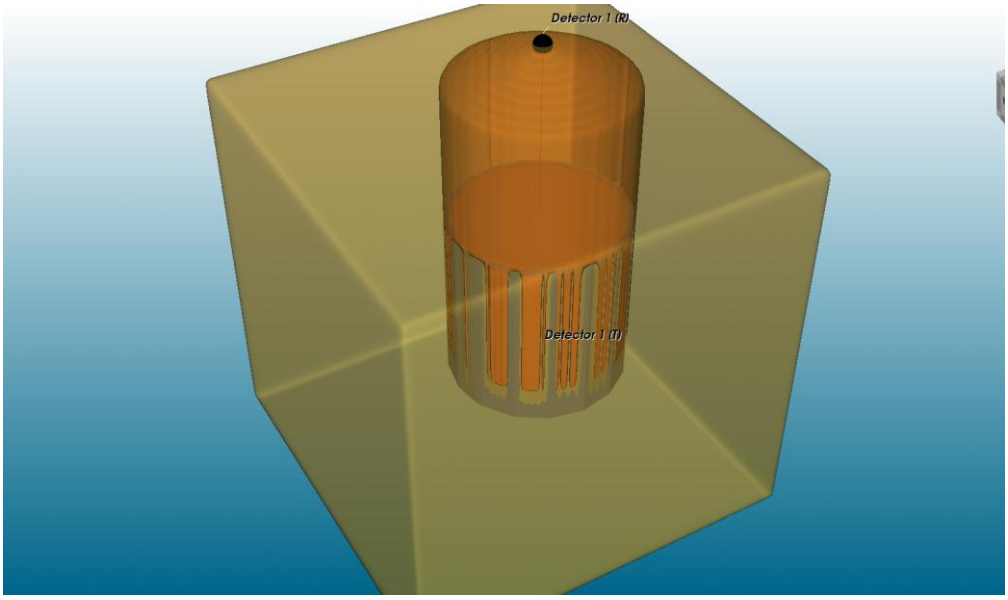
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	9.44	9.47	0.03



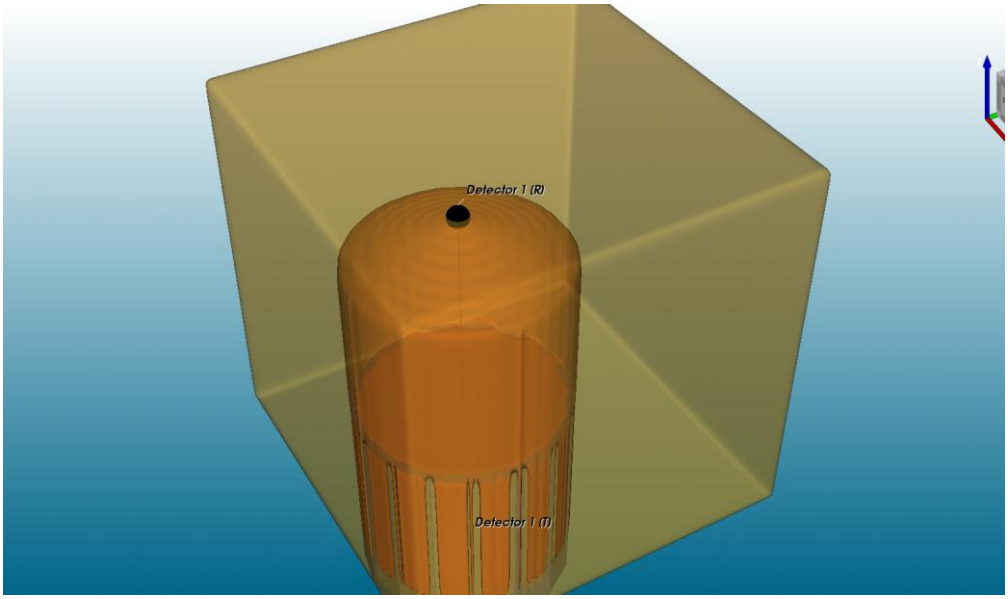
View 1



View 2



View 3



View 4

5.5.11 One PGD with its FOI completely inside a cubical grade but outside a cylindrical & a cubical geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

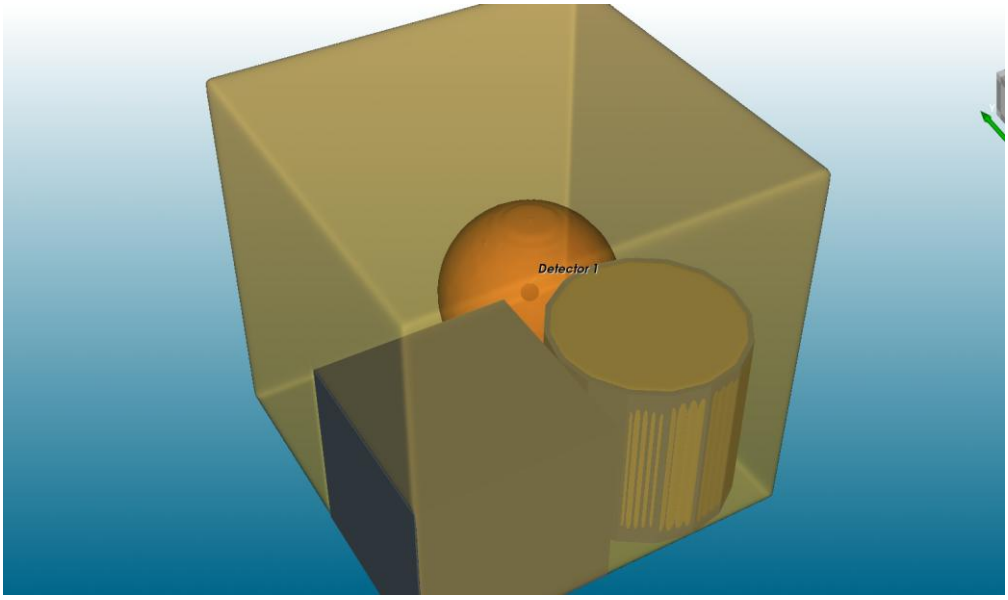
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

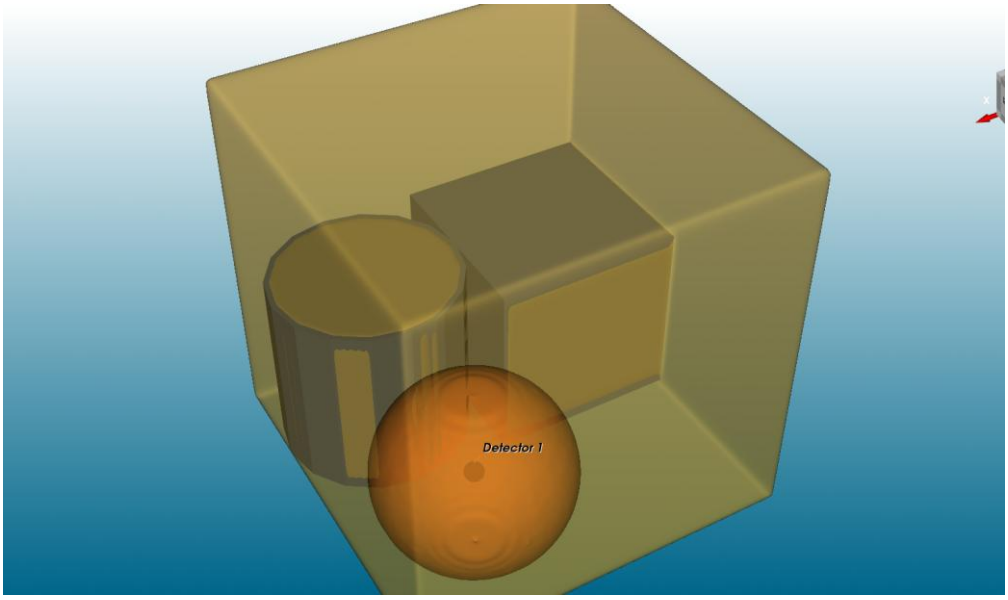
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m

Coverage Results

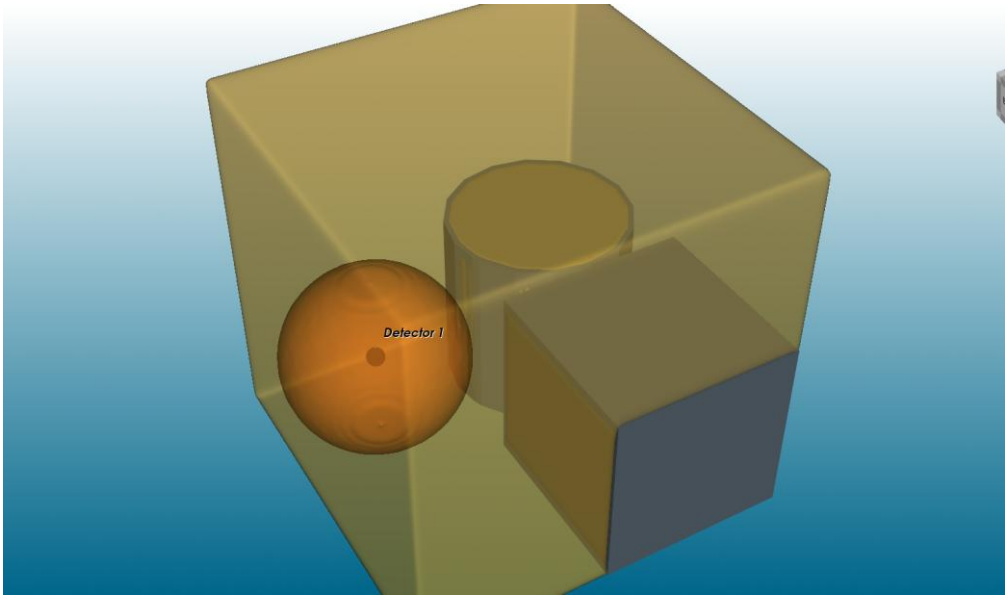
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	8.43	8.35	0.08



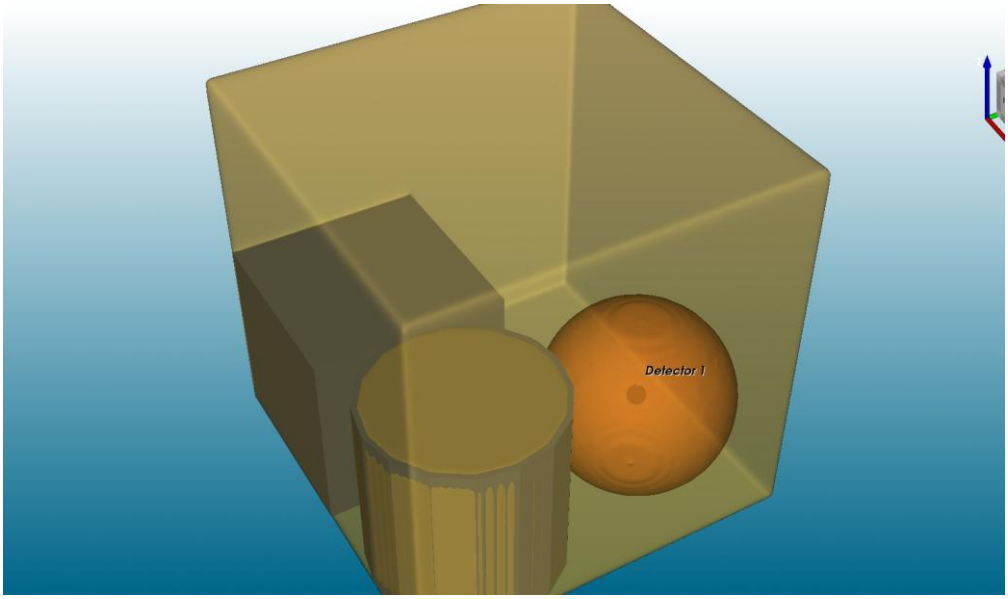
View 1



View 2



View 3



View 4

5.5.12 One OPGD with its FOI completely inside a cubical grade but outside a cylindrical & a cubical geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

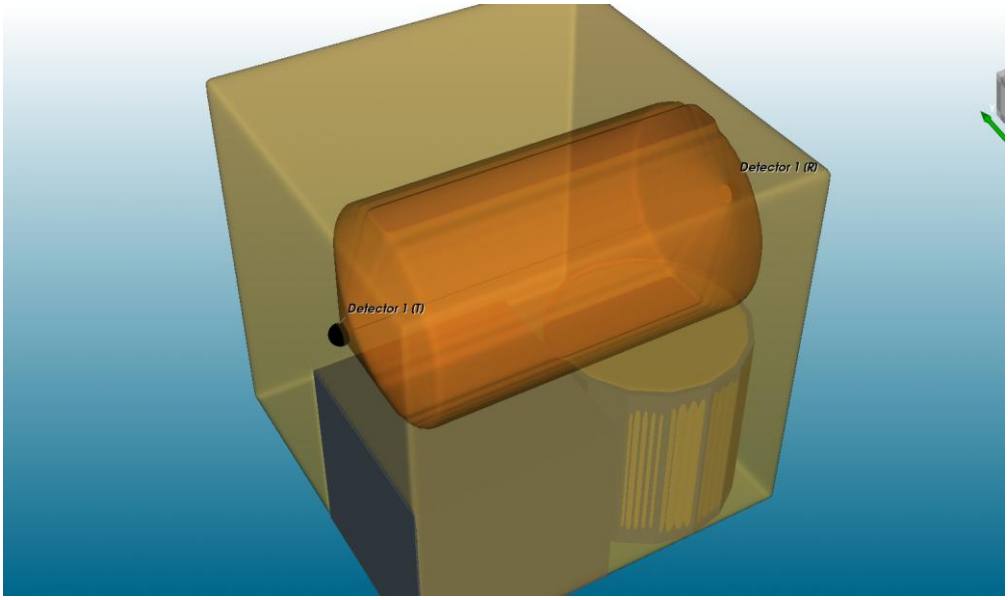
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

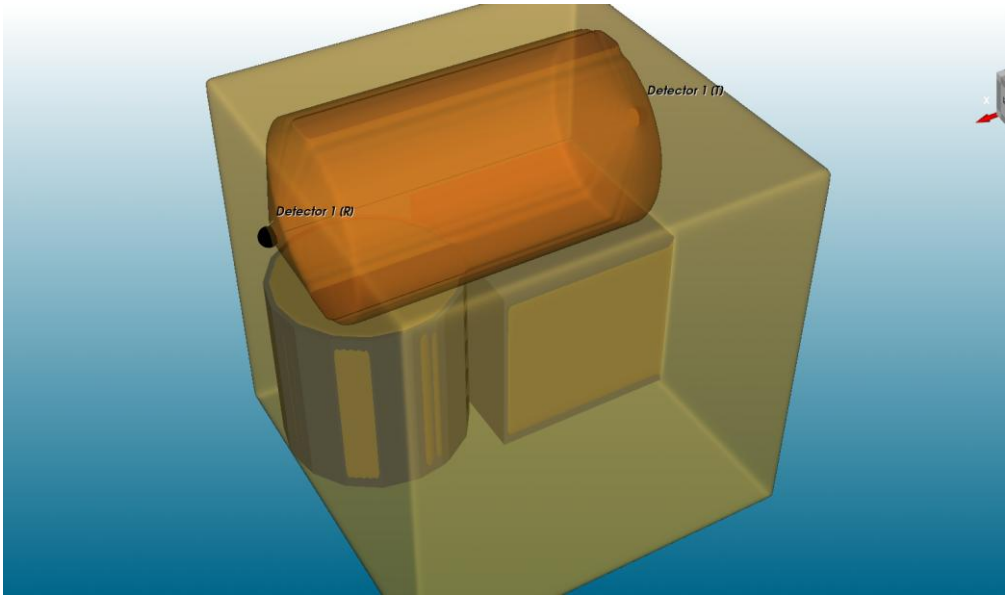
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade B - 10 m

Coverage Results

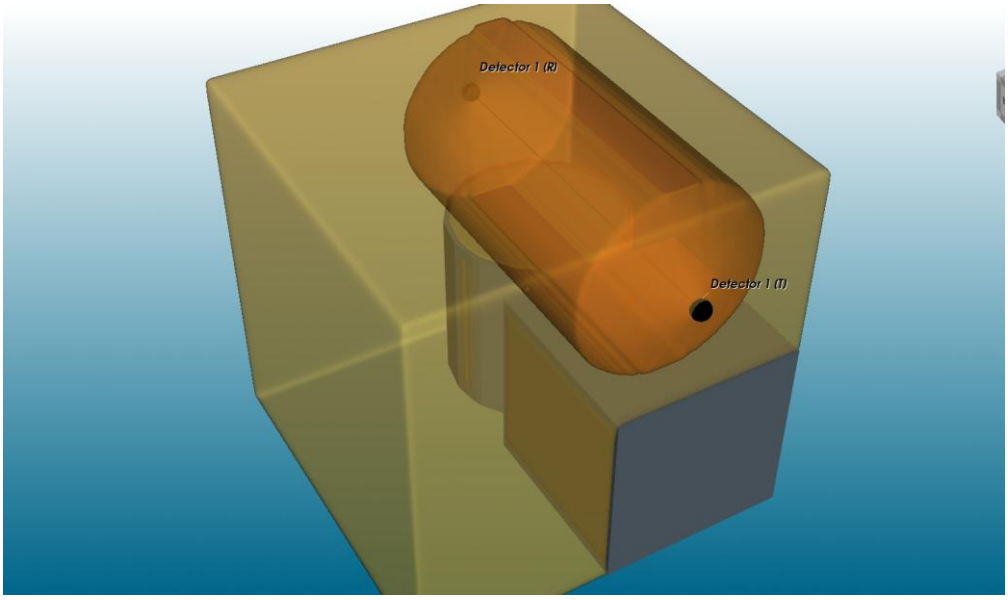
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	21.91	21.69	0.22



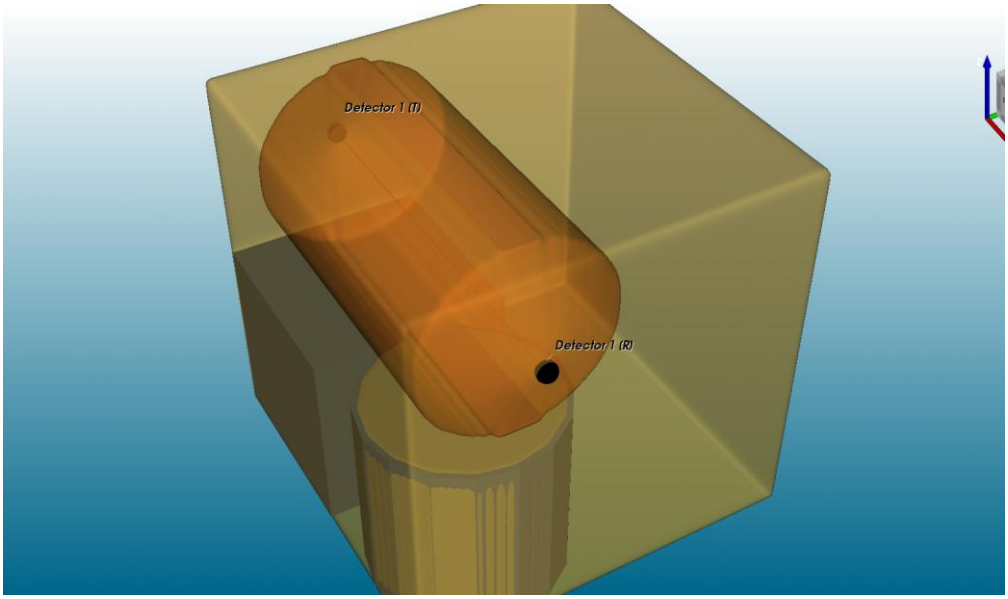
View 1



View 2



View 3



View 4

5.5.13 Two same type cubical grades used. One grade (Open type) surrounds a cubical gemoetry. Another grade (again open type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

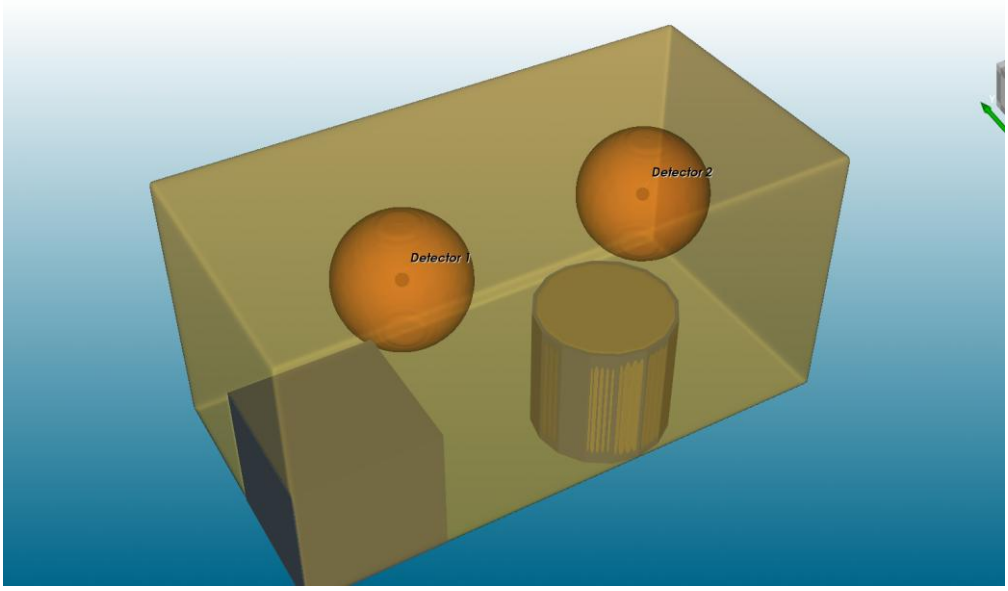
Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	HC	Grade B - 10 m

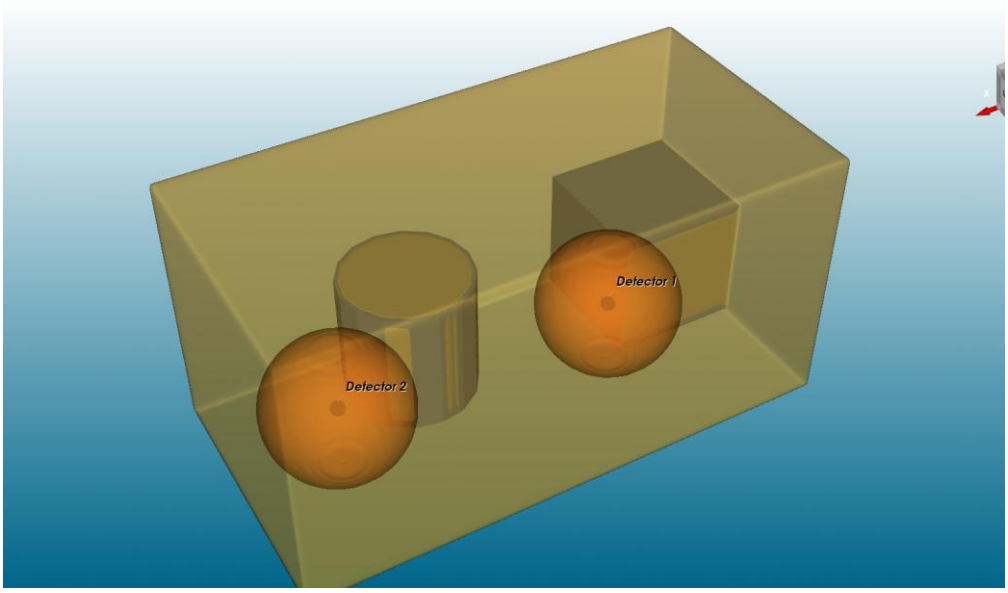
Coverage Results

Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	7.37	7.33	0.04

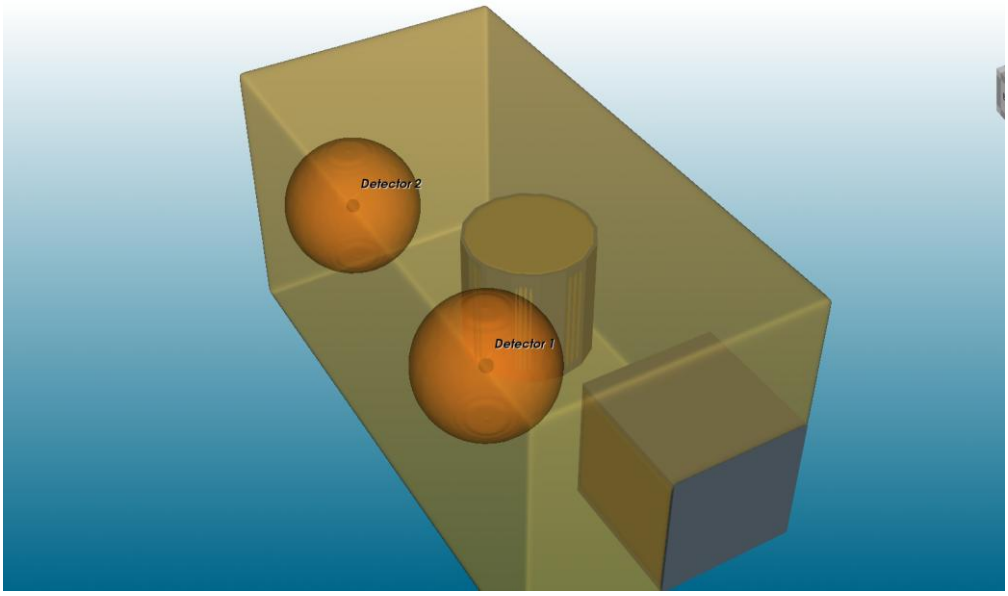
Note: Two independent grades, each with its own detector clear of its own geometry piece.



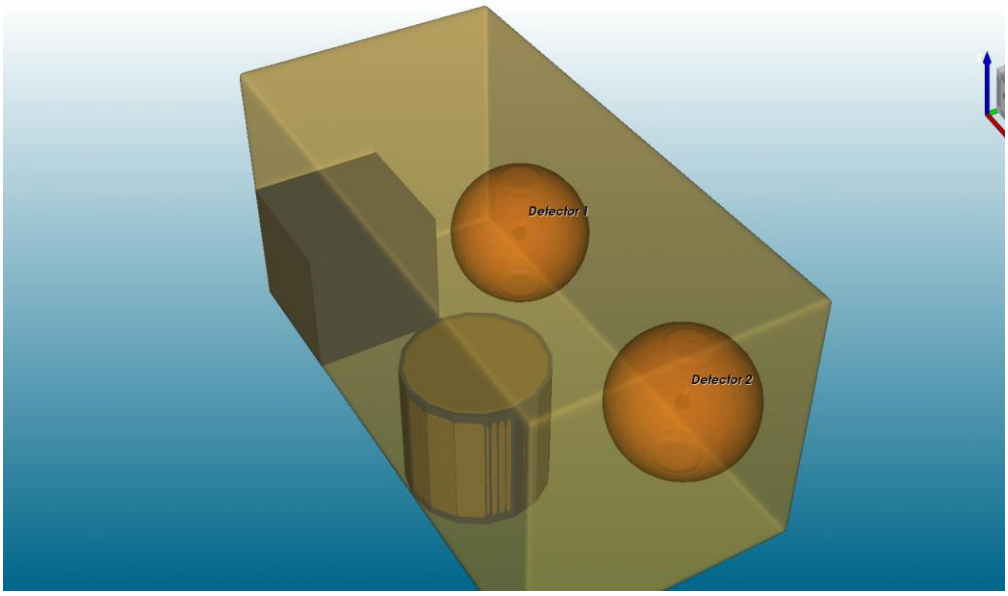
View 1



View 2



View 3



View 4

5.5.14 Two different types cubical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

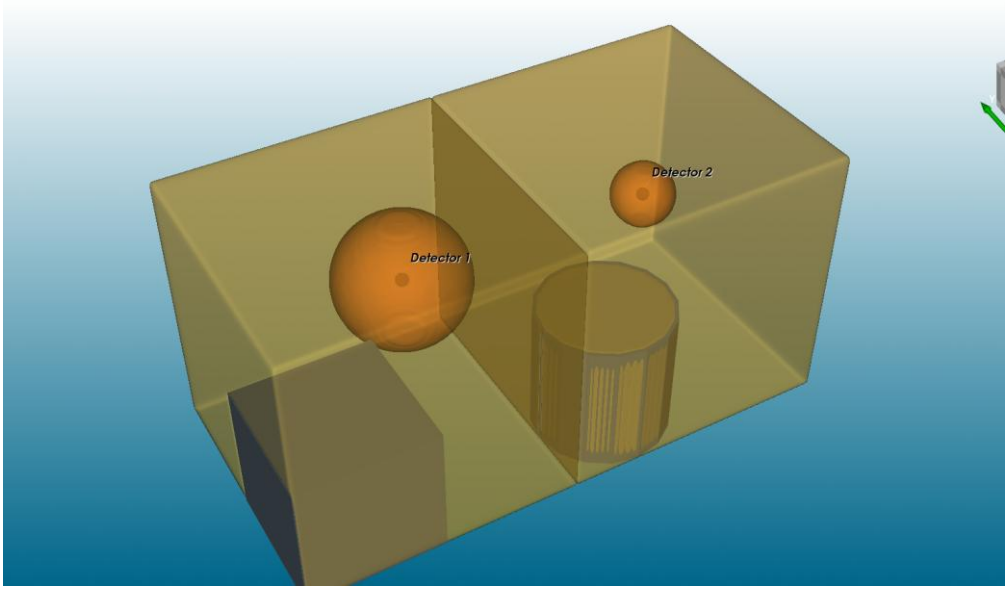
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

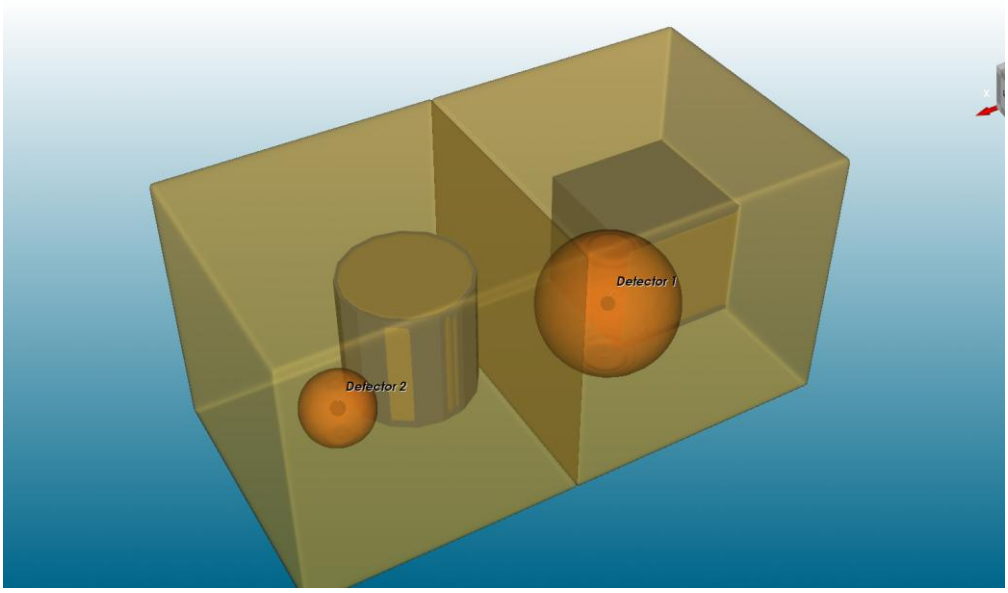
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - 10 m Grade D - 5 m
Point Gas Detector (PGD)	HC	Grade A - 10 m Grade D - 5 m

Coverage Results

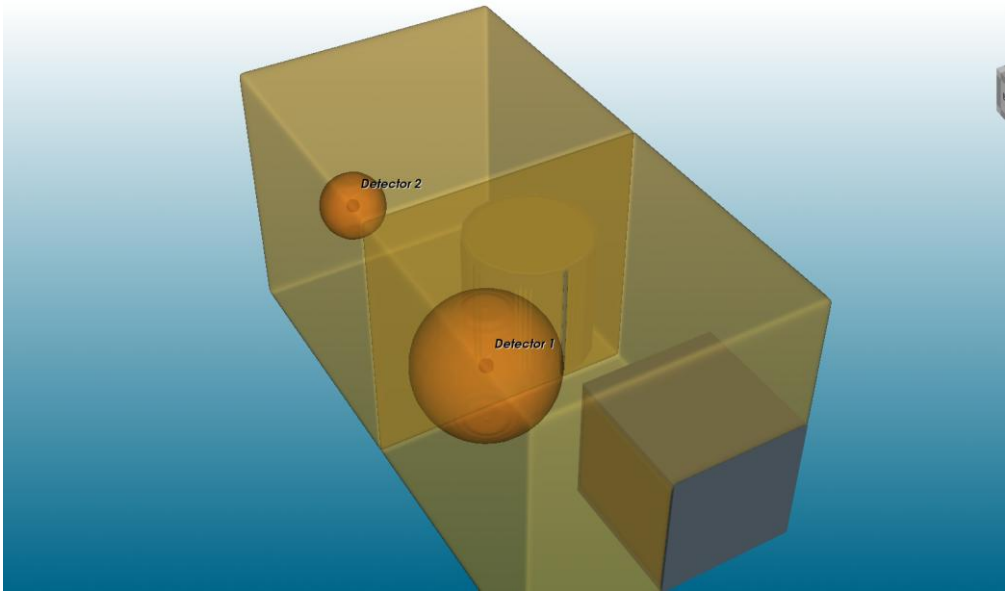
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	7.48	7.44	0.04
Grade D	1ooN	0.91	0.9	0.01



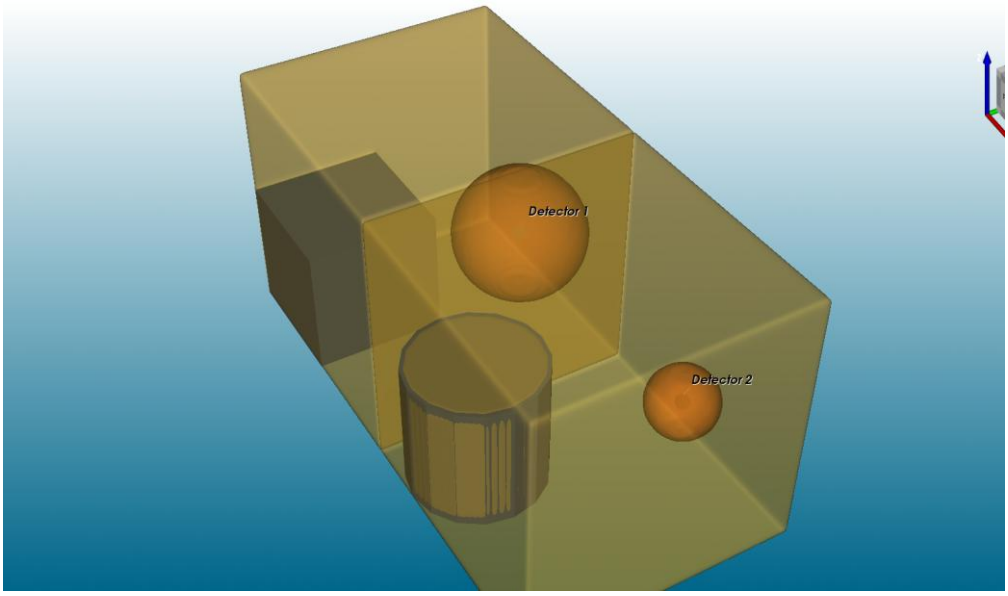
View 1



View 2



View 3



View 4

5.5.15 Two same type cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (again open type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

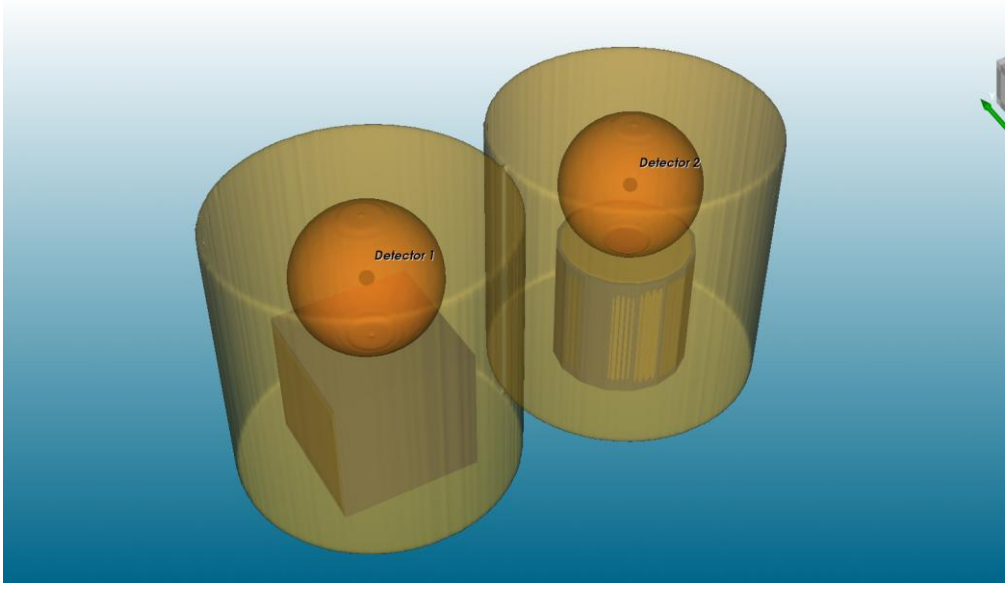
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade B
Cylinder	Radius 10 m, Height 20 m	Grade B

Gas Detectors

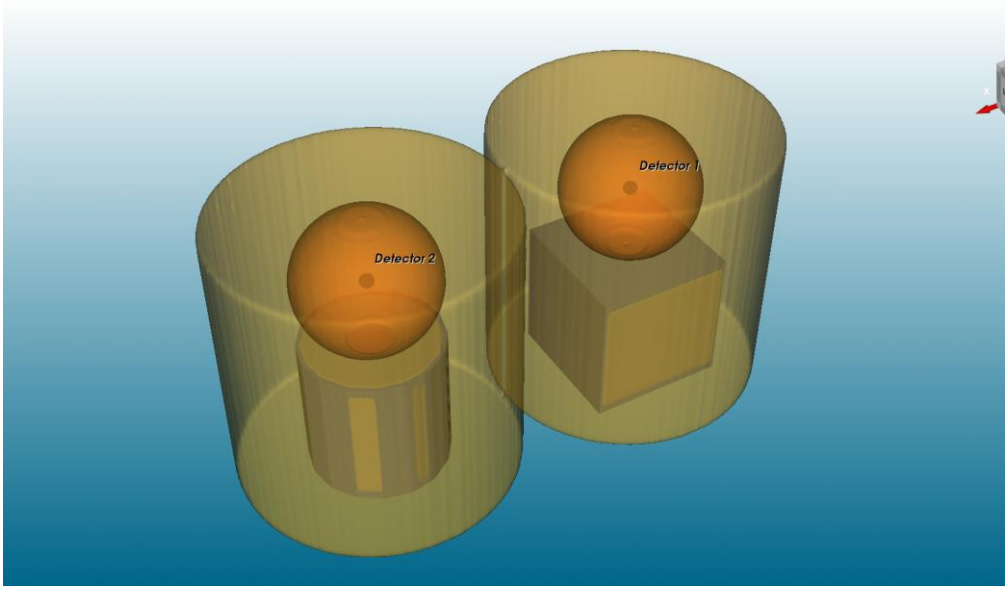
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	HC	Grade B - 10 m

Coverage Results

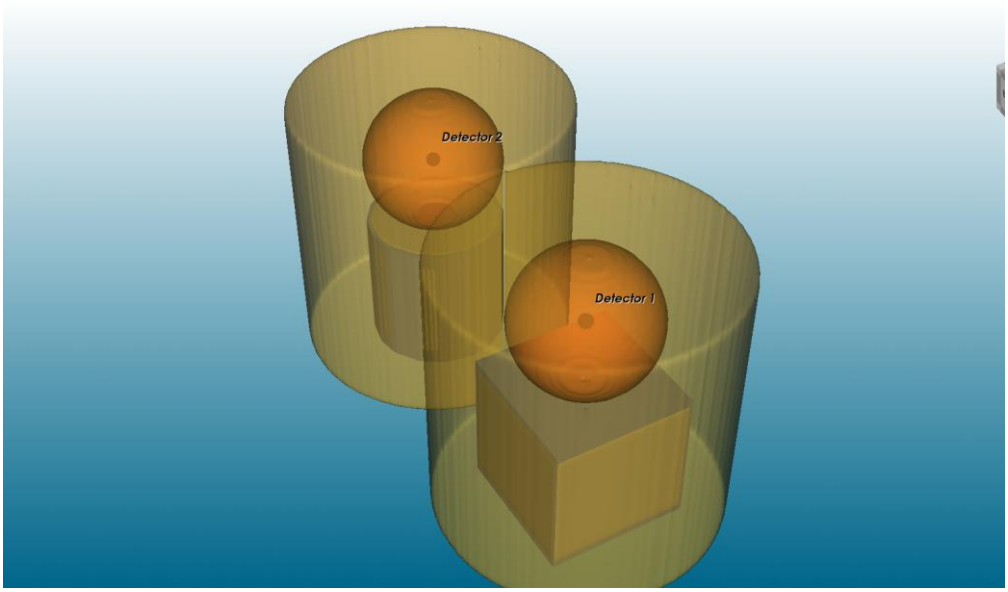
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	9.71	9.67	0.04



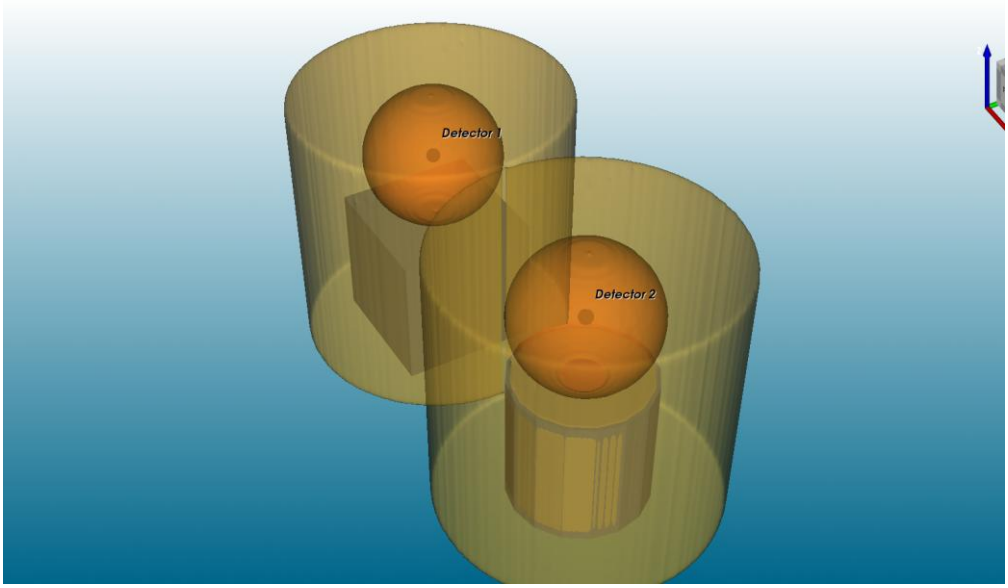
View 1



View 2



View 3



View 4

5.5.16 Two same type cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (again open type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but half portion of FOI being outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

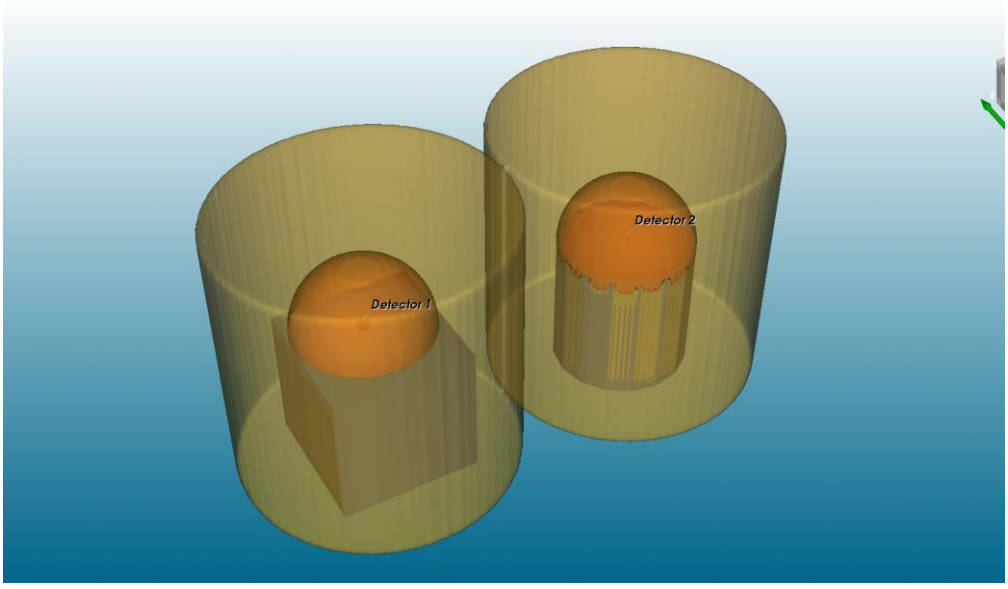
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade B
Cylinder	Radius 10 m, Height 20 m	Grade B

Gas Detectors

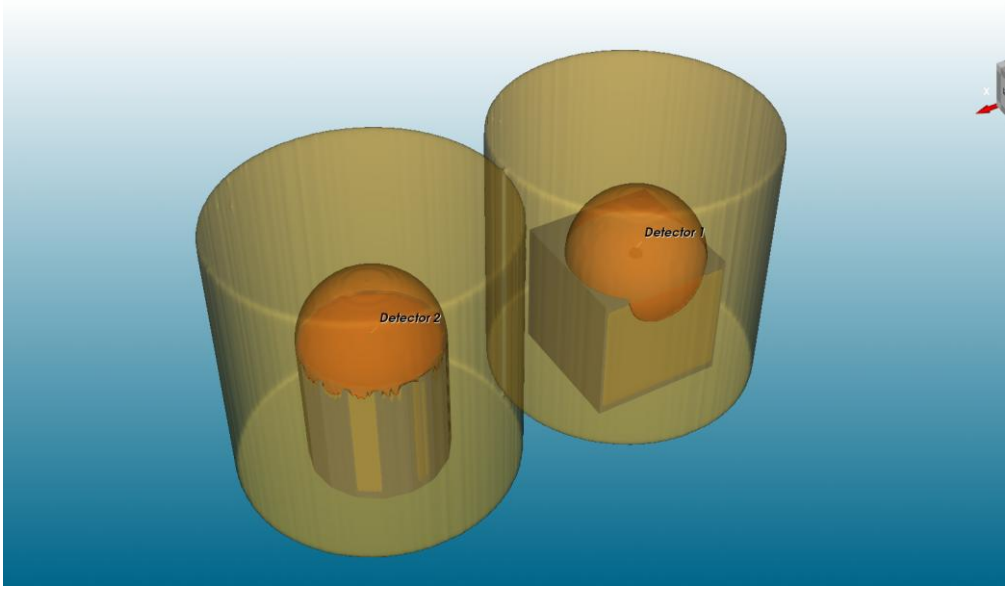
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - 10 m
Point Gas Detector (PGD)	HC	Grade B - 10 m

Coverage Results

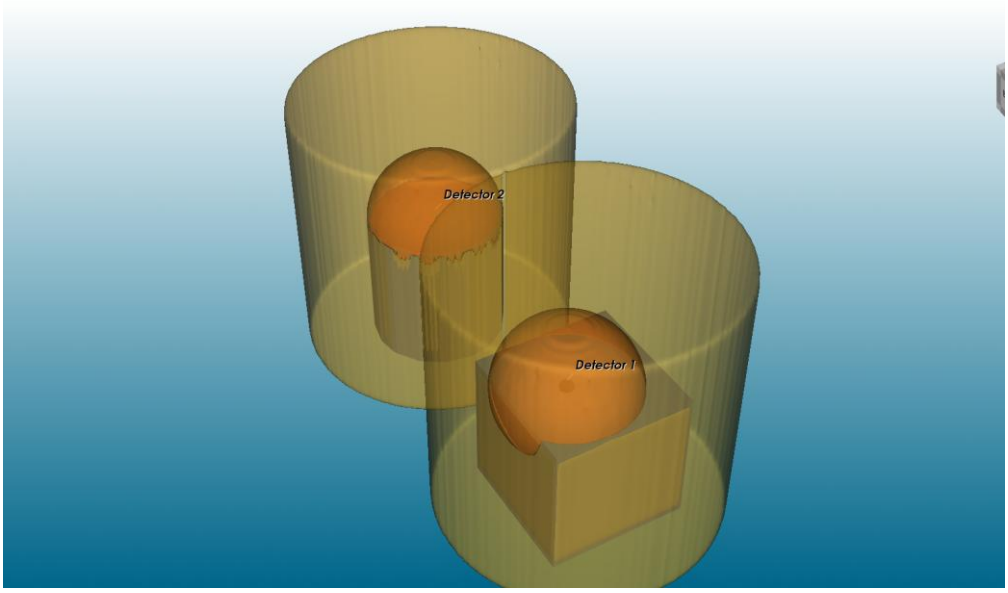
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	4.86	4.93	0.07



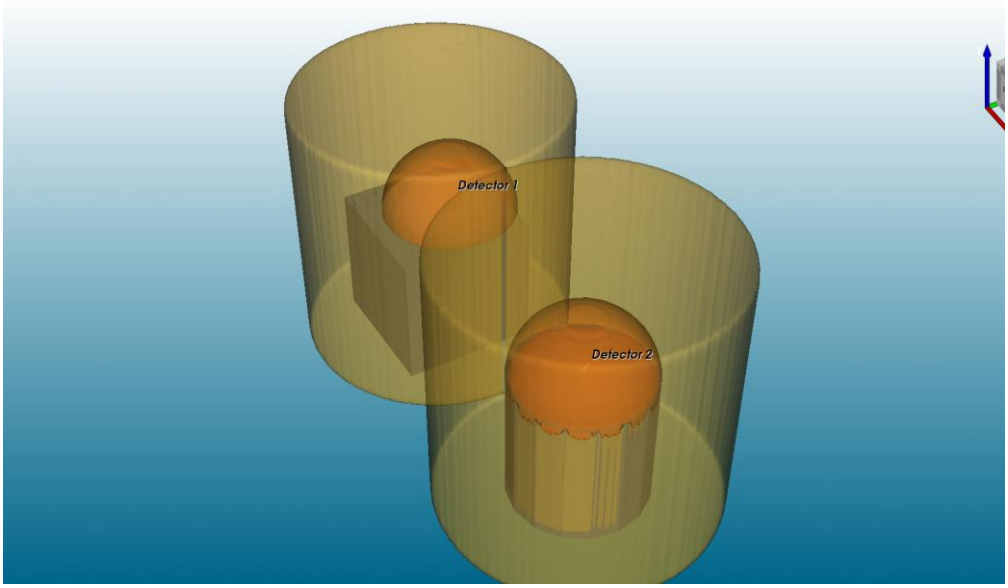
View 1



View 2



View 3



View 4

5.5.17 Two different types cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

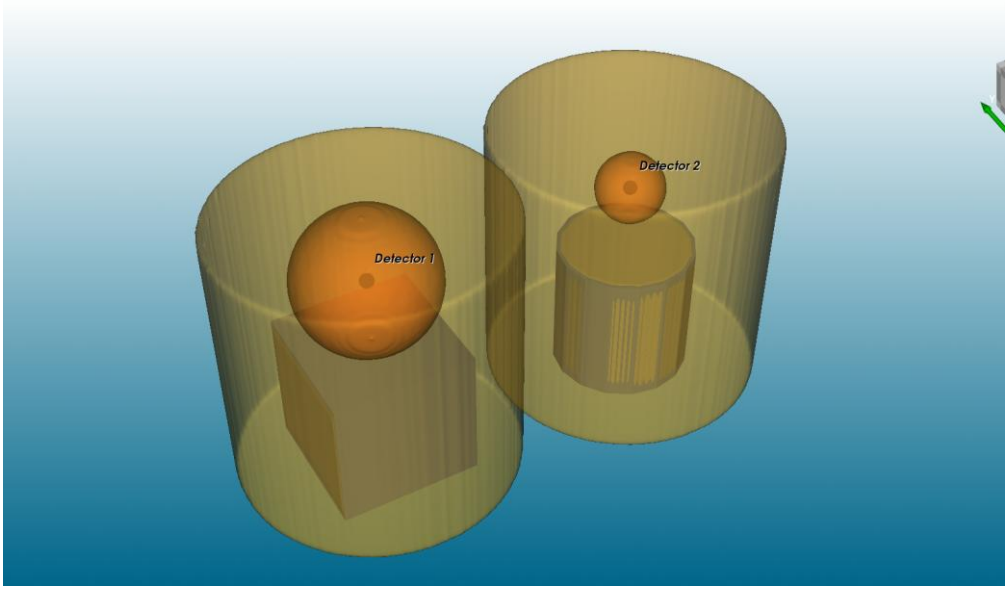
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade D
Cylinder	Radius 10 m, Height 20 m	Grade C

Gas Detectors

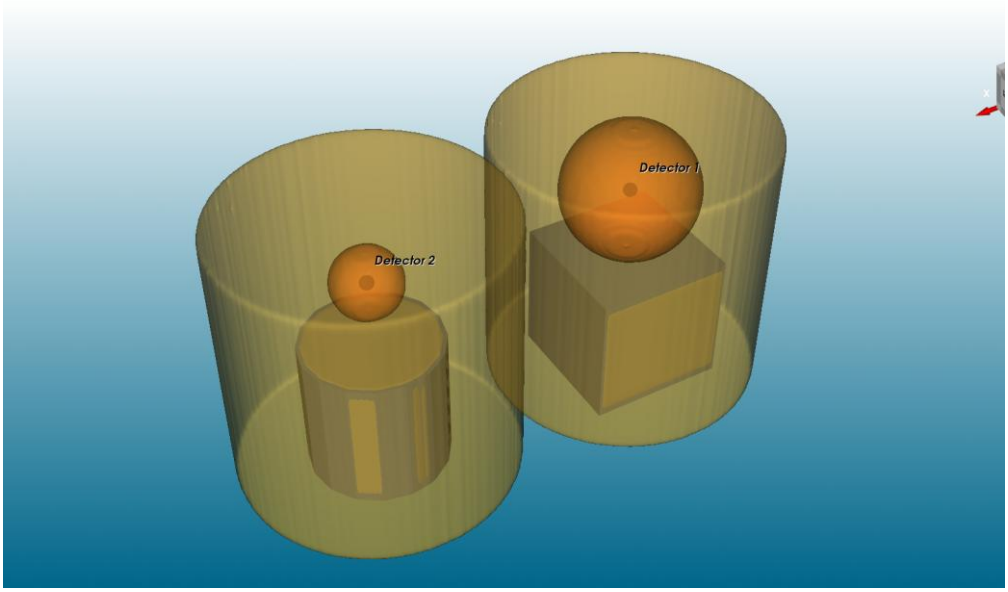
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m Grade C - 5 m
Point Gas Detector (PGD)	HC	Grade D - 10 m Grade C - 5 m

Coverage Results

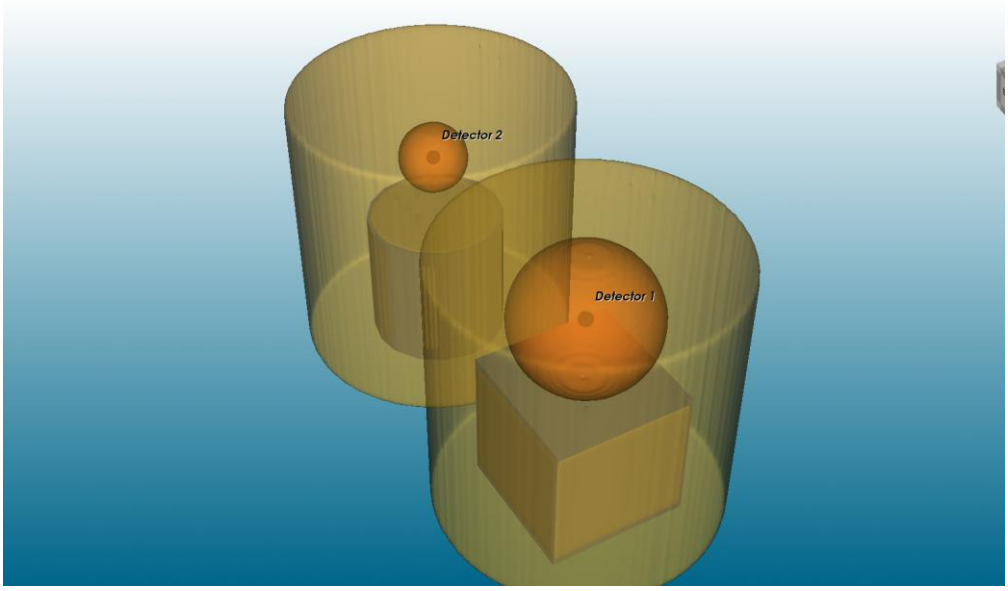
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	9.91	9.86	0.05
Grade C	1ooN	1.19	1.18	0.01



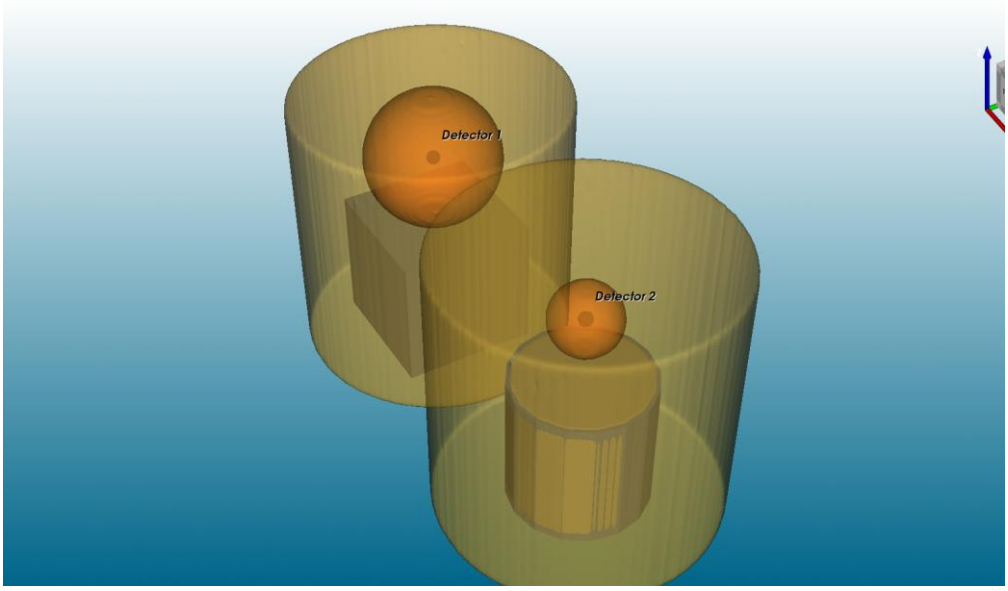
View 1



View 2



View 3



View 4

5.5.18 Two same type cubical grades used. One grade (Open type) surrounds a cubical gemoetry. Another grade (again open type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

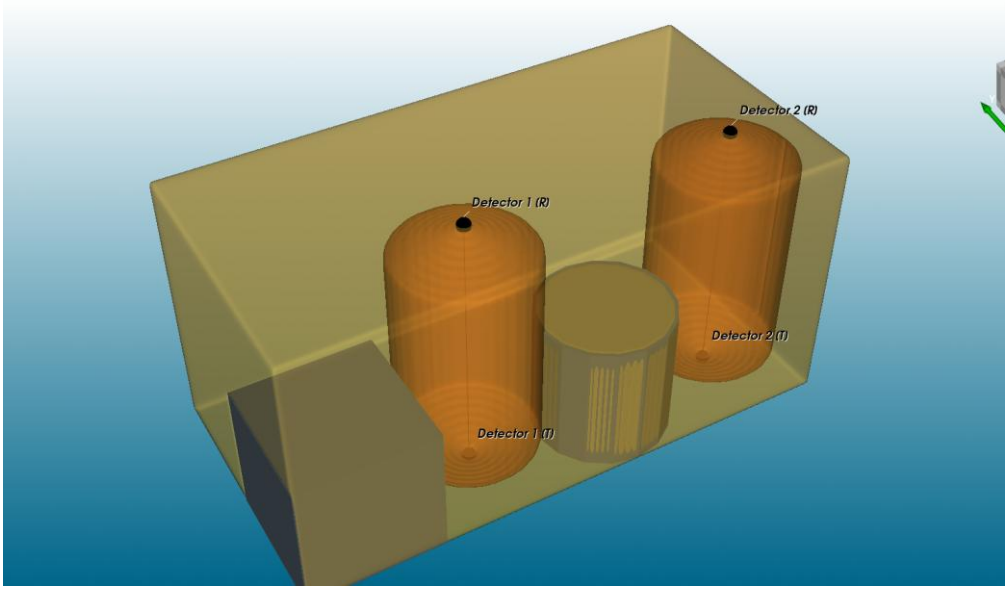
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

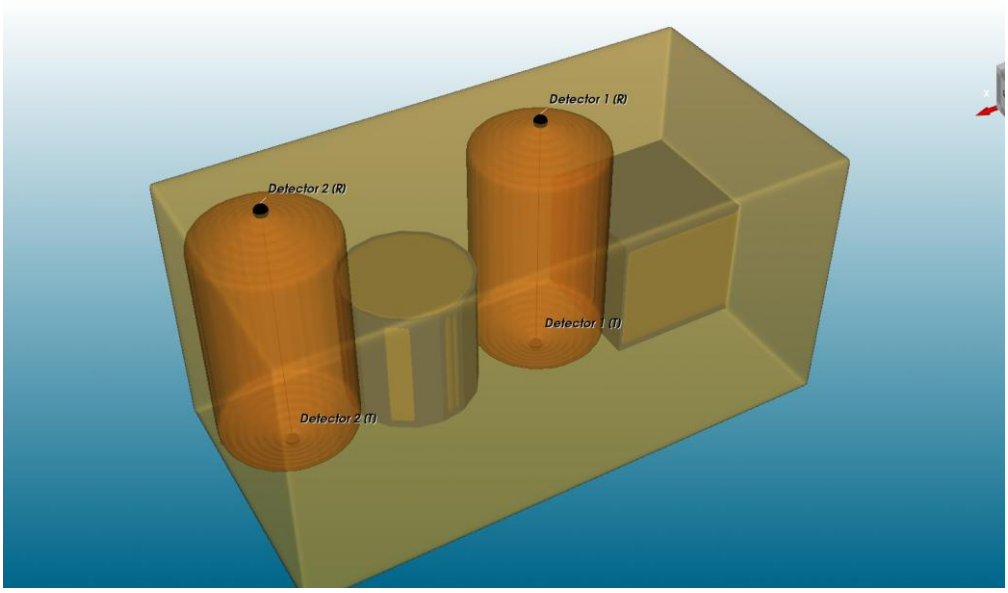
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m

Coverage Results

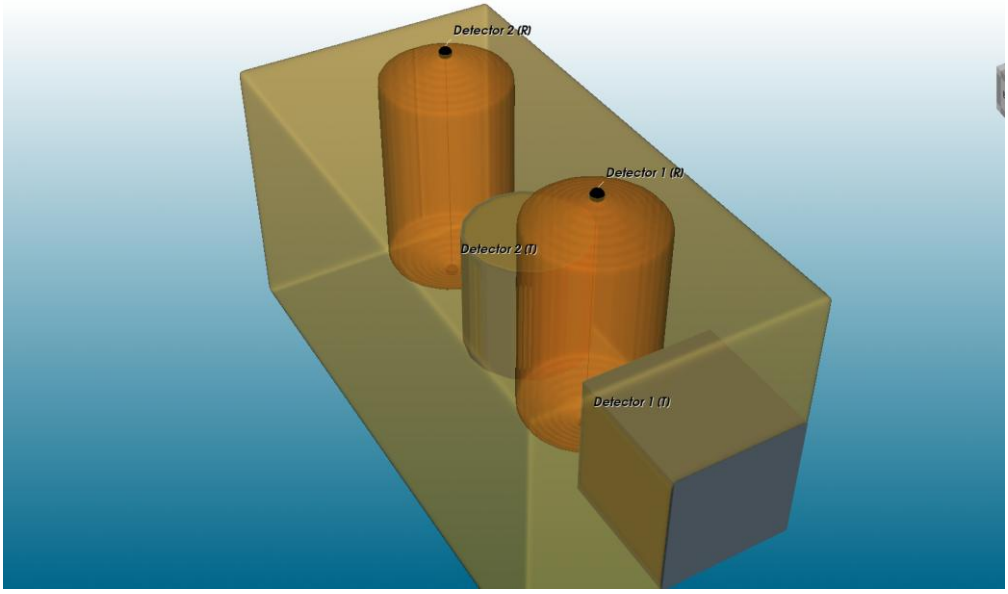
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	19.15	19.08	0.07


Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

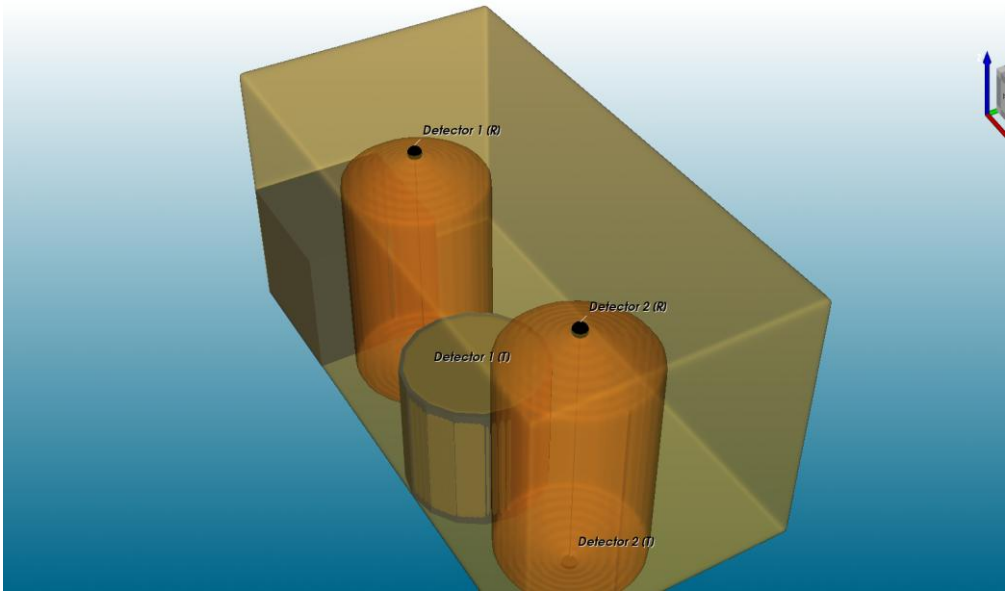
View 1


Detector 1 (R)
Detector 2 (R)
Detector 1 (T)
Detector 2 (T)

View 2


Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

View 3


Detector 1 (R)
Detector 2 (R)
Detector 1 (T)
Detector 2 (T)

View 4

5.5.19 Two different types cubical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

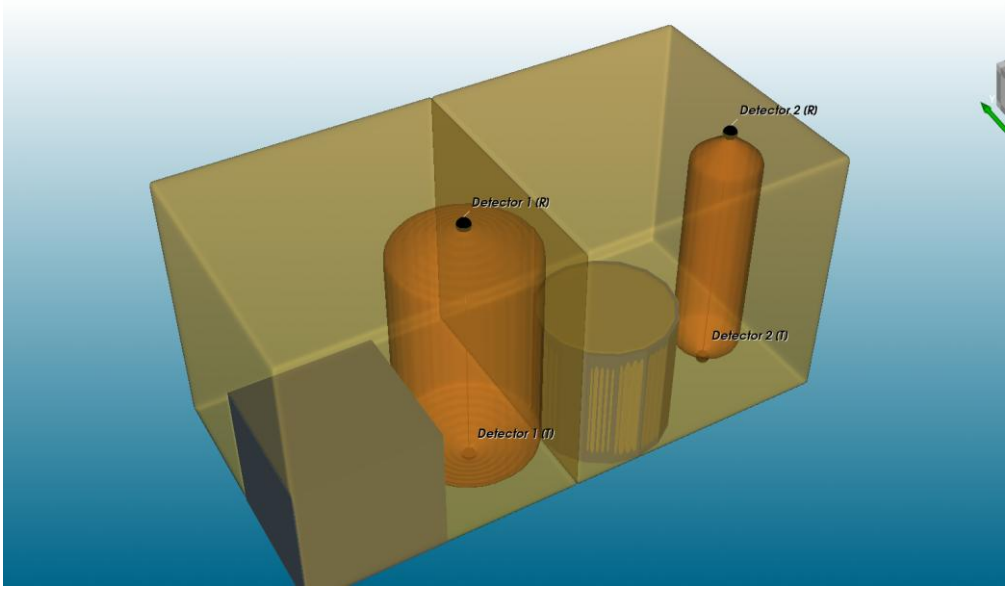
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

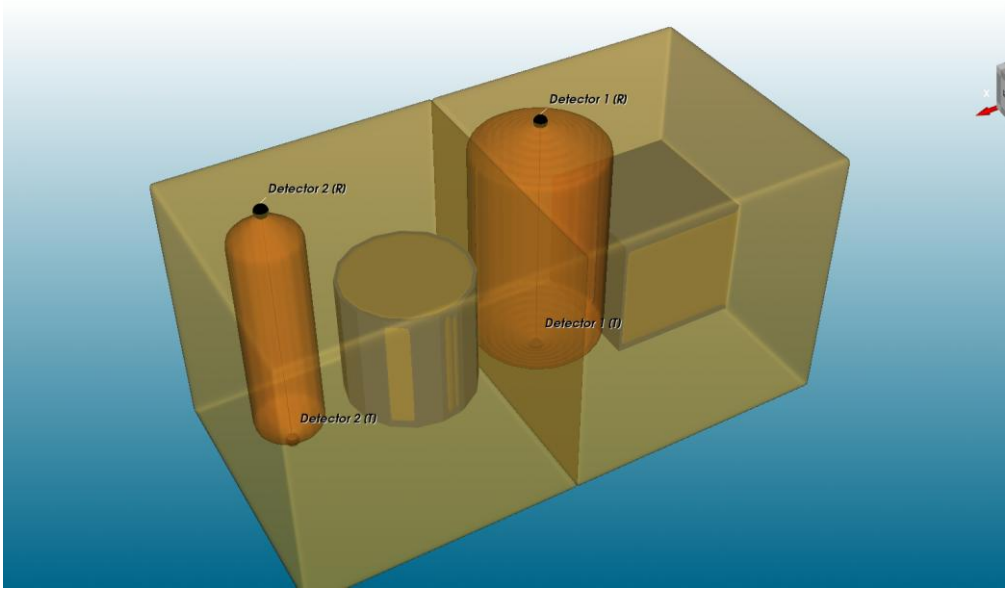
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m Grade D - 5 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m Grade D - 5 m

Coverage Results

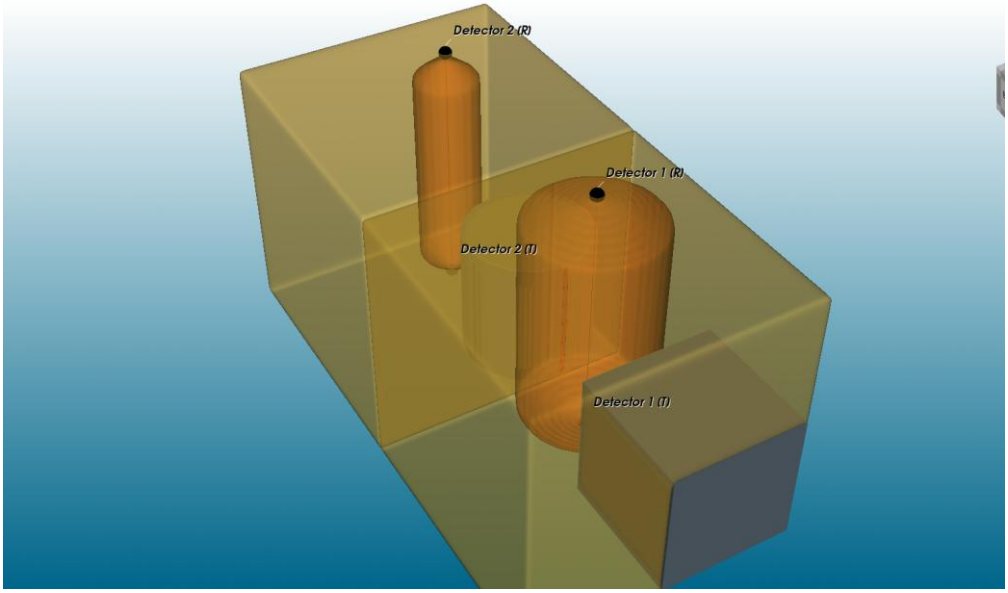
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	19.45	19.35	0.10
Grade D	1ooN	4.72	4.7	0.02


Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

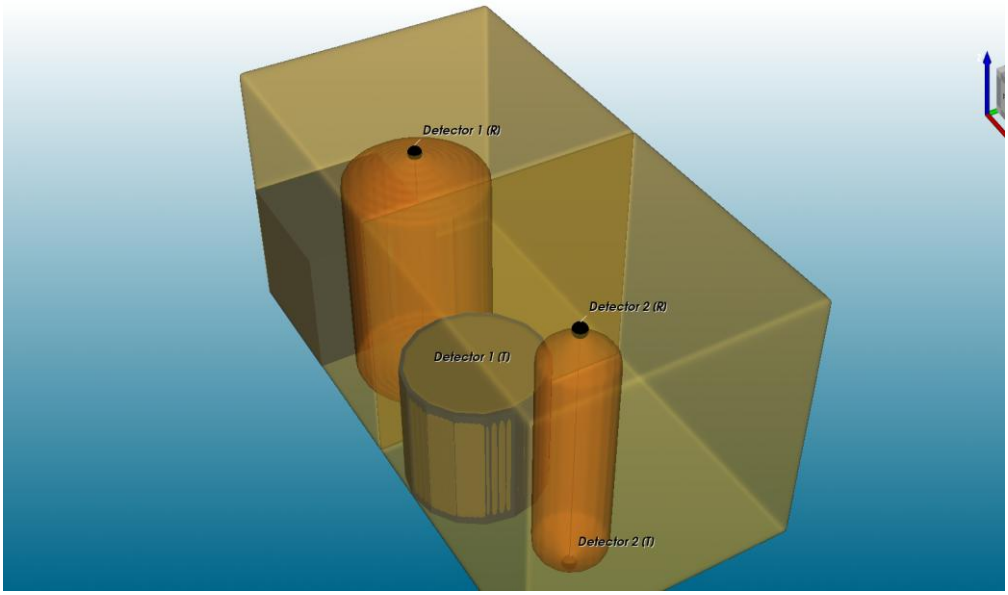
View 1


Detector 1 (R)
Detector 2 (R)
Detector 1 (T)
Detector 2 (T)

View 2


Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

View 3


Detector 1 (R)
Detector 2 (R)
Detector 1 (T)
Detector 2 (T)

View 4

5.5.20 Two same type cylindrical grades used. One grade (Open type) surrounds a cubical gemoetry. Another grade (again open type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

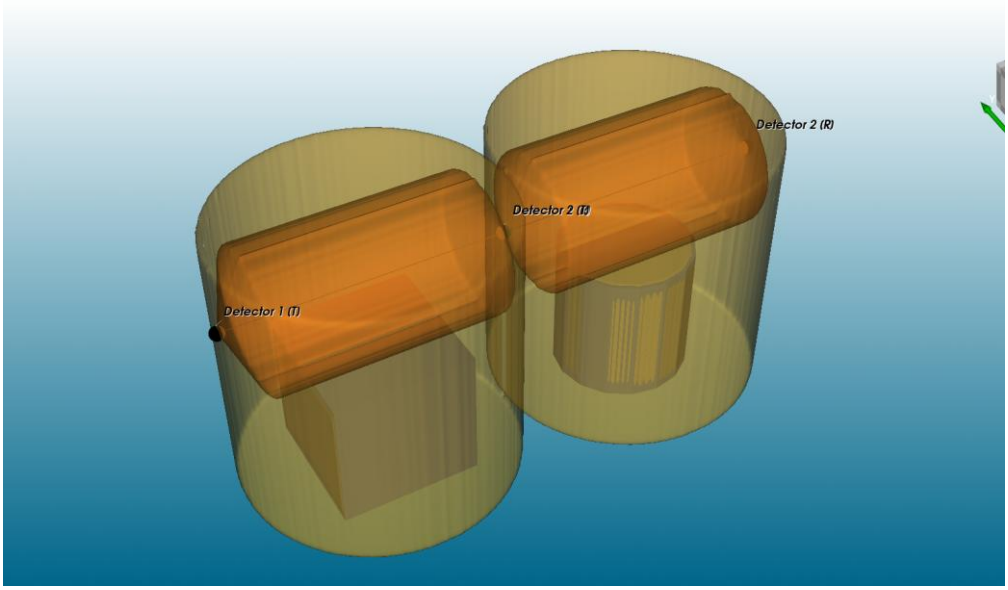
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade C
Cylinder	Radius 10 m, Height 20 m	Grade C

Gas Detectors

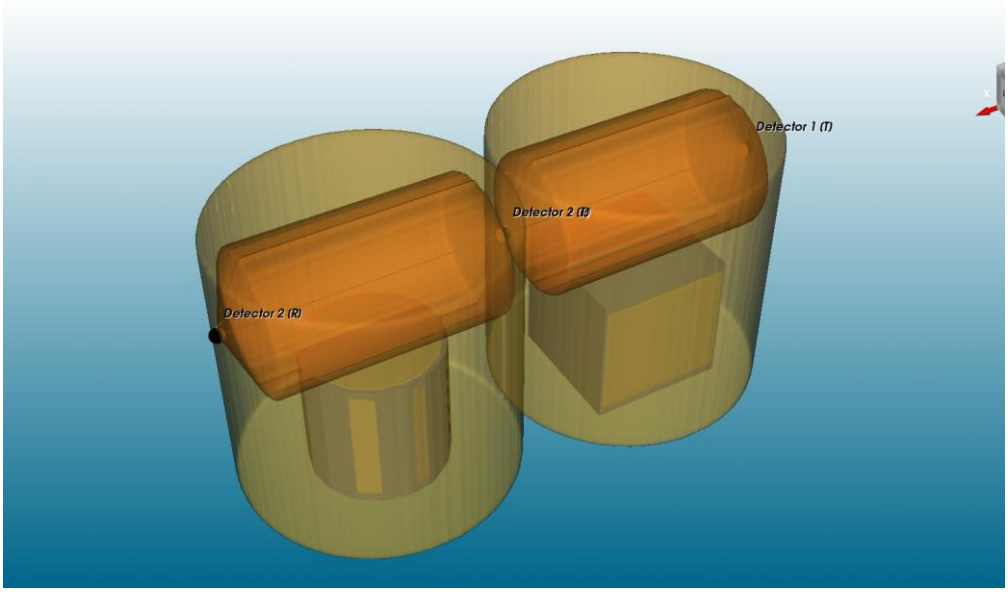
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - 10 m

Coverage Results

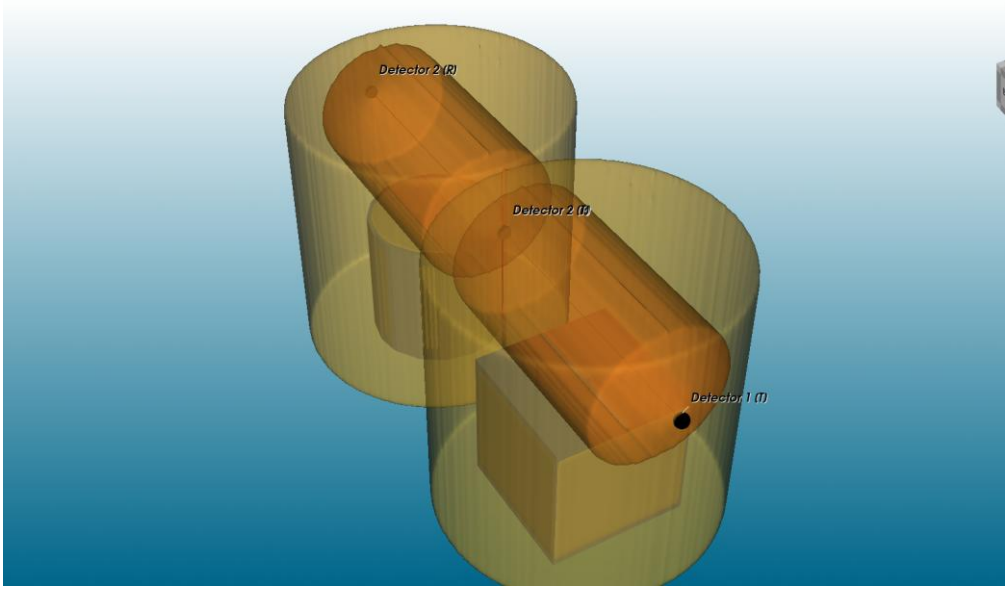
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	25.26	25.05	0.21


Detector 2 (R)
Detector 2 (F)
Detector 1 (T)

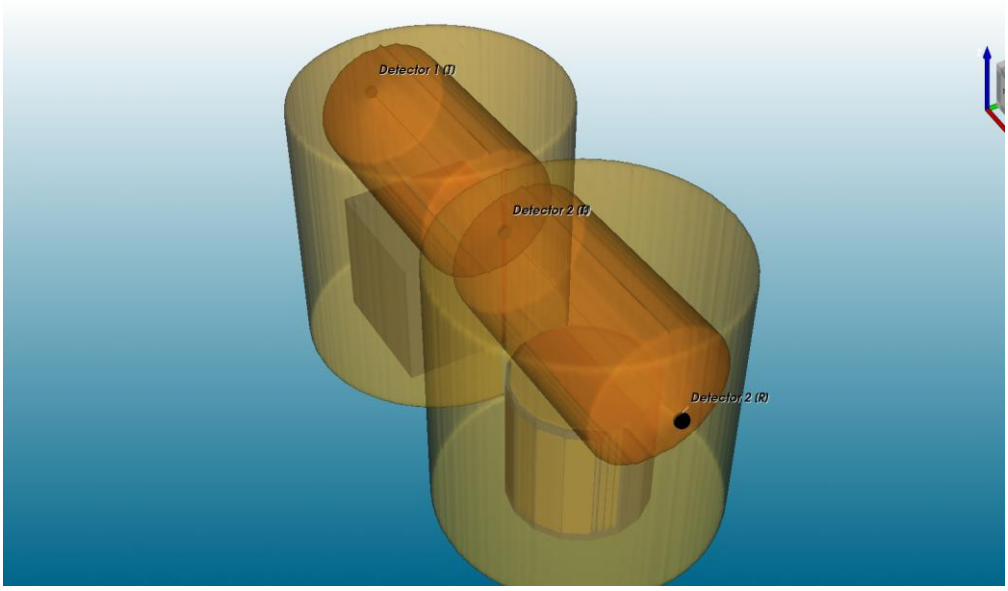
View 1


Detector 1 (T)
Detector 2 (F)
Detector 2 (R)

View 2


Detector 2 (R)
Detector 2 (I)
Detector 1 (I)

View 3


Detector 1 (I)
Detector 2 (I)
Detector 2 (R)

View 4

5.5.21 Two different types cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

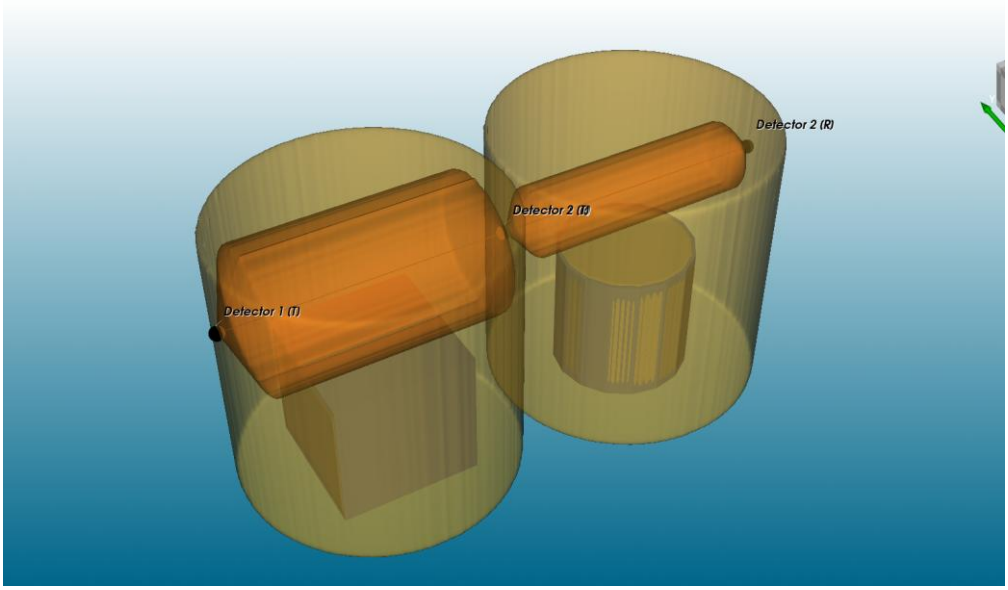
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade A
Cylinder	Radius 10 m, Height 20 m	Grade C

Gas Detectors

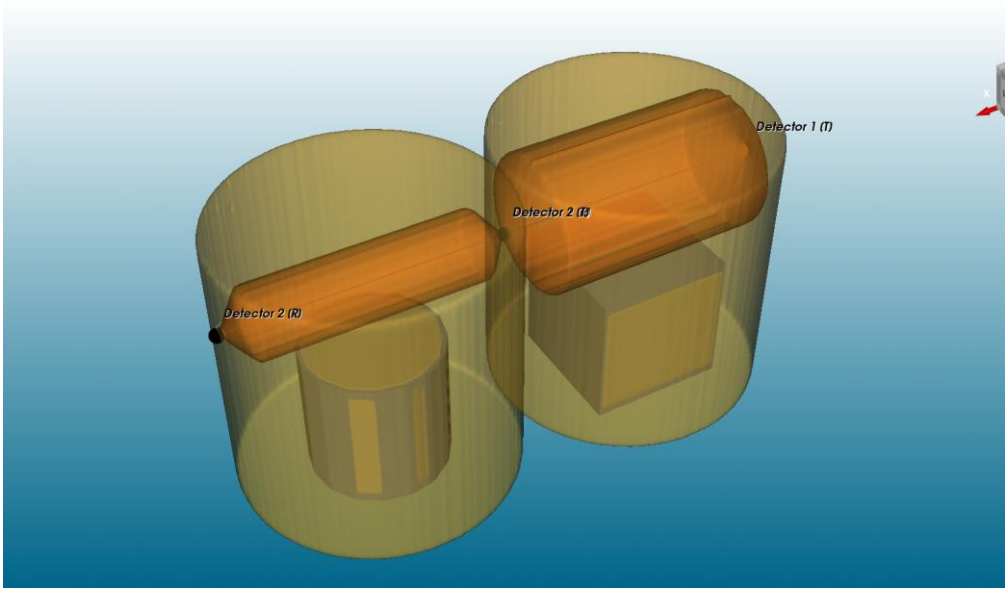
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - 10 m Grade C - 5 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - 10 m Grade C - 5 m

Coverage Results

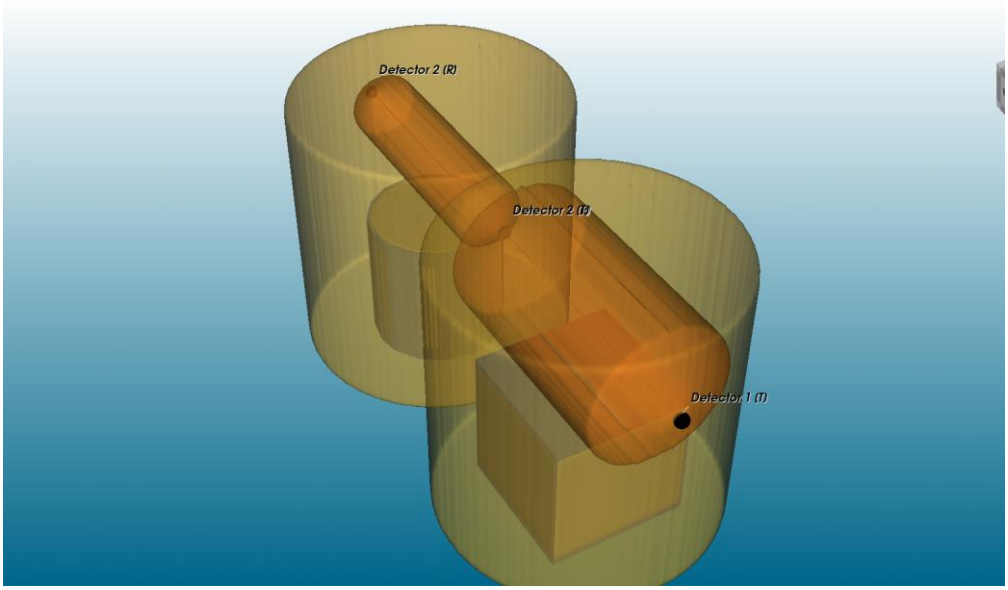
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	25.77	25.54	0.23
Grade C	1ooN	6.19	6.1	0.09


Detector 2 (R)
Detector 2 (F)
Detector 1 (T)

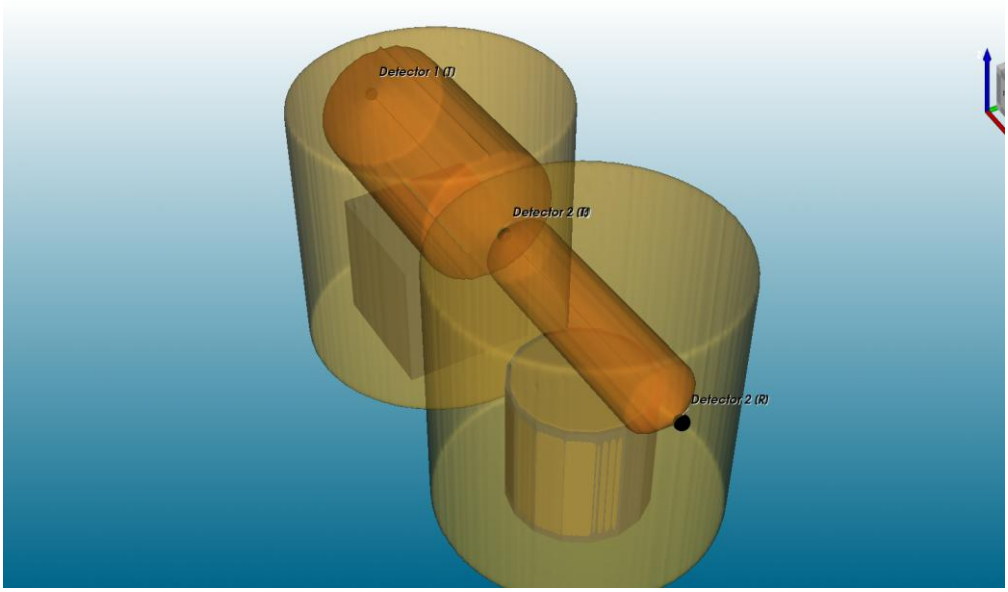
View 1


Detector 1 (T)
Detector 2 (F)
Detector 2 (R)

View 2


Detector 2 (R)
Detector 2 (T)
Detector 1 (T)

View 3


Detector 1 (T)
Detector 2 (T)
Detector 2 (R)

View 4

5.6 Cross Credit Validation with Geometry

5.6.1 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade but outside the geometry.

Risk Grades

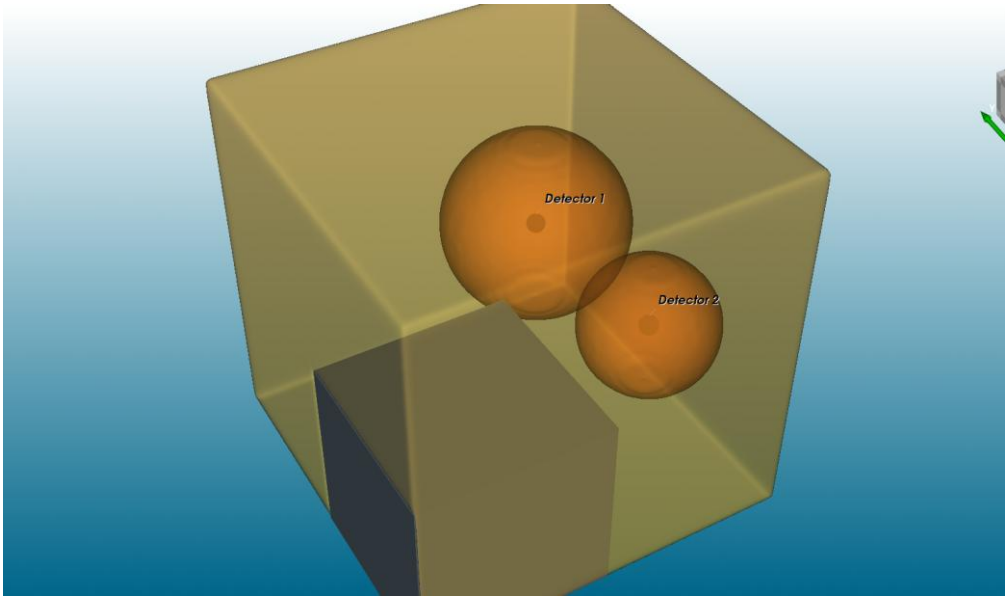
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

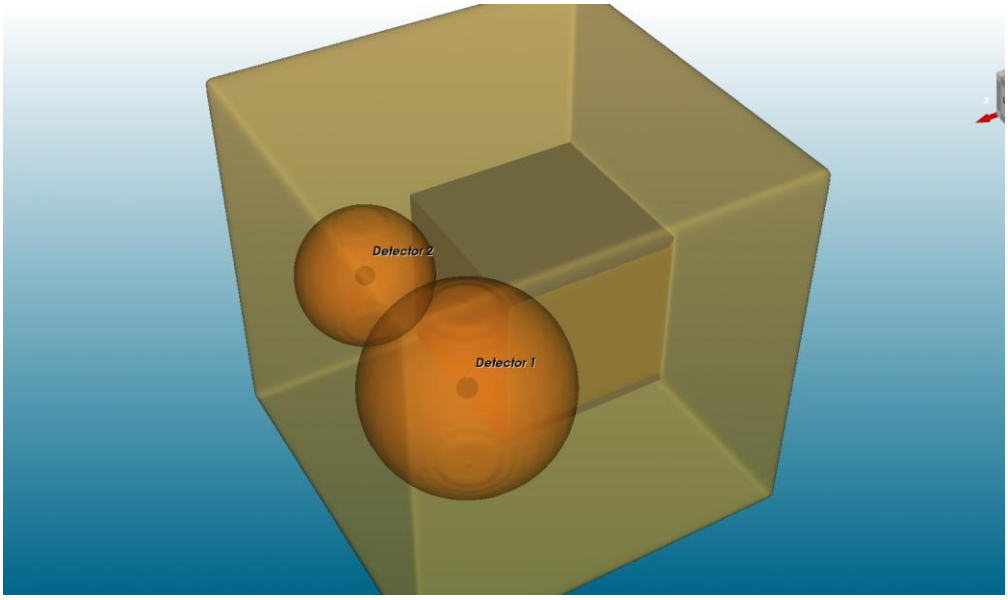
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m
Point Gas Detector (PGD)	H2S	Grade D - 7 m

Coverage Results

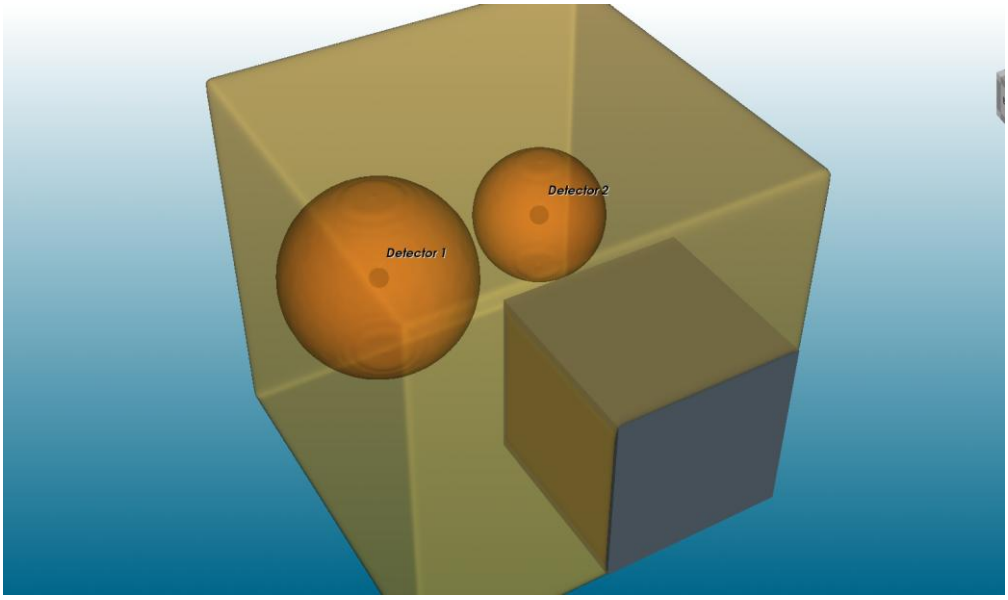
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	10.05	9.99	0.06



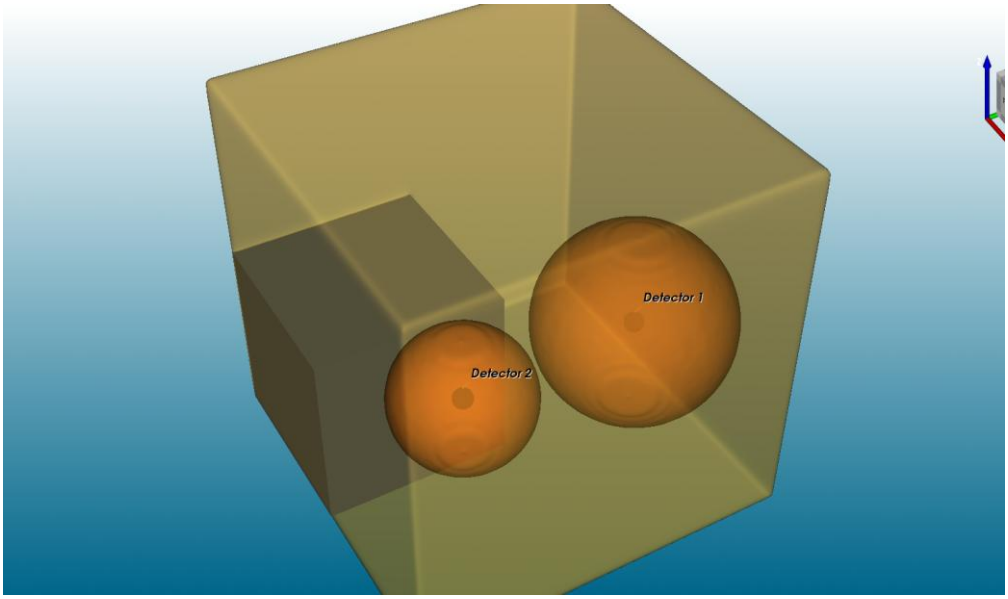
View 1



View 2



View 3



View 4

5.6.2 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade. HC detector's FOI is outside the geometry. H2S detector's FOI is half inside the geometry.

Risk Grades

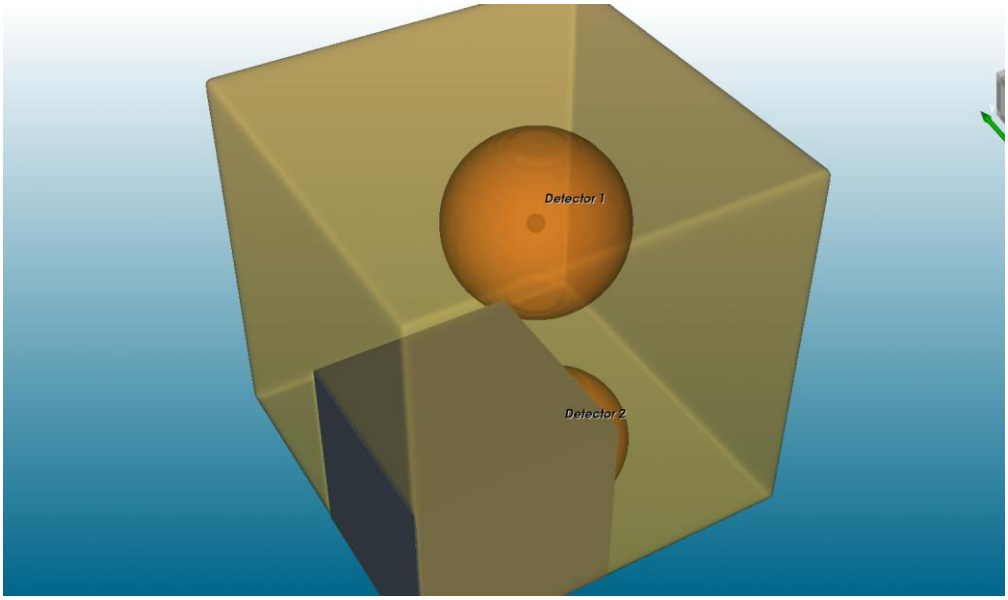
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

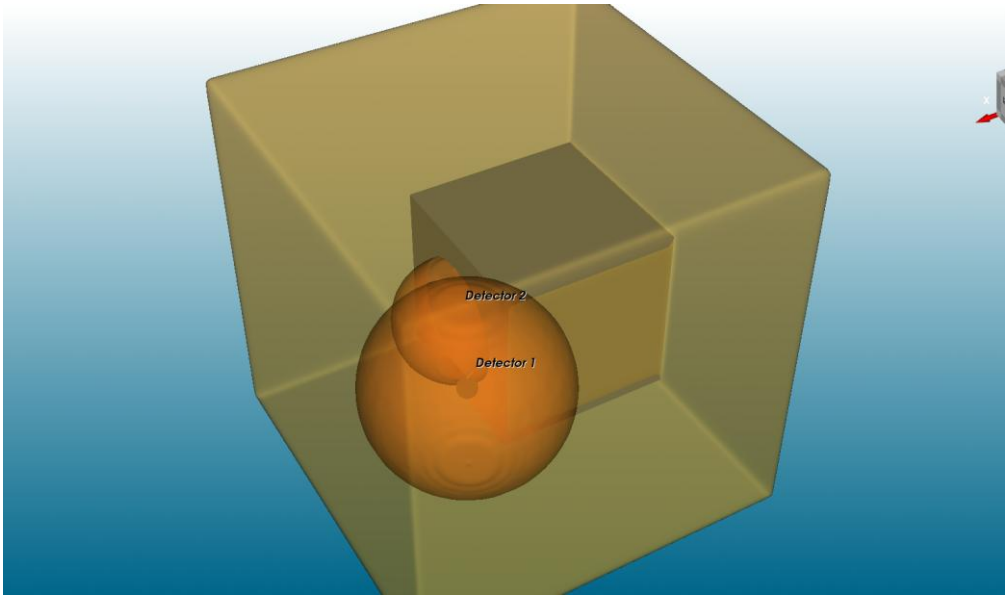
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - 10 m
Point Gas Detector (PGD)	H2S	Grade A - 7 m

Coverage Results

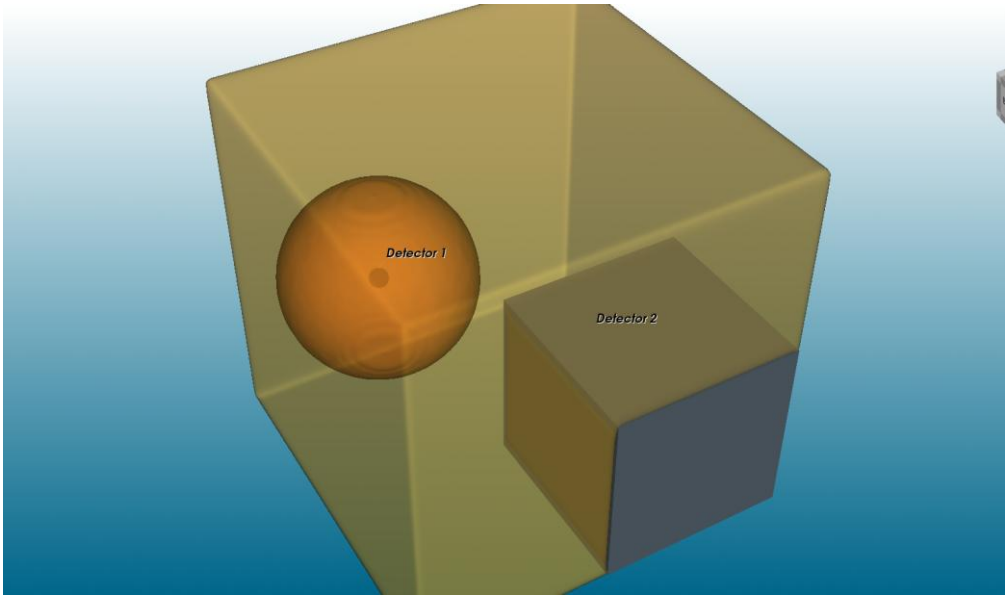
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	8.76	8.74	0.02



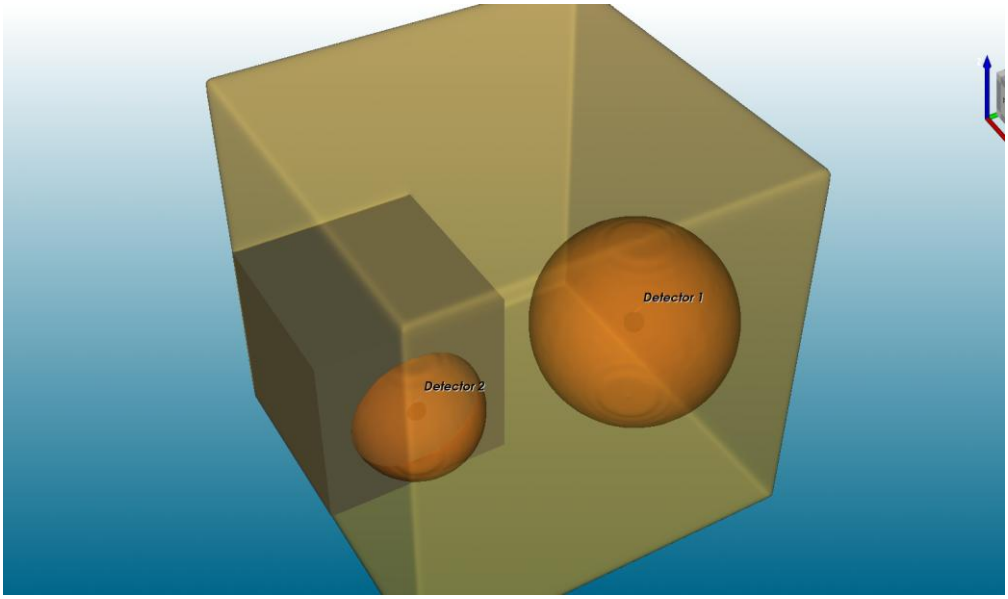
View 1



View 2



View 3



View 4

5.6.3 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade. H2S detector's FOI is outside the geometry. HC detector's FOI is half inside the geometry.

Risk Grades

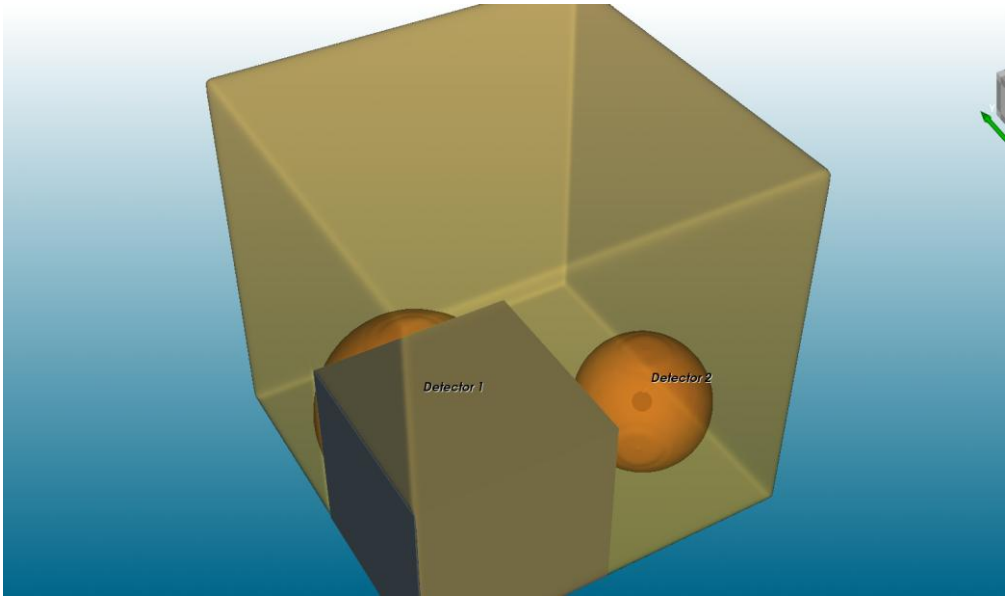
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

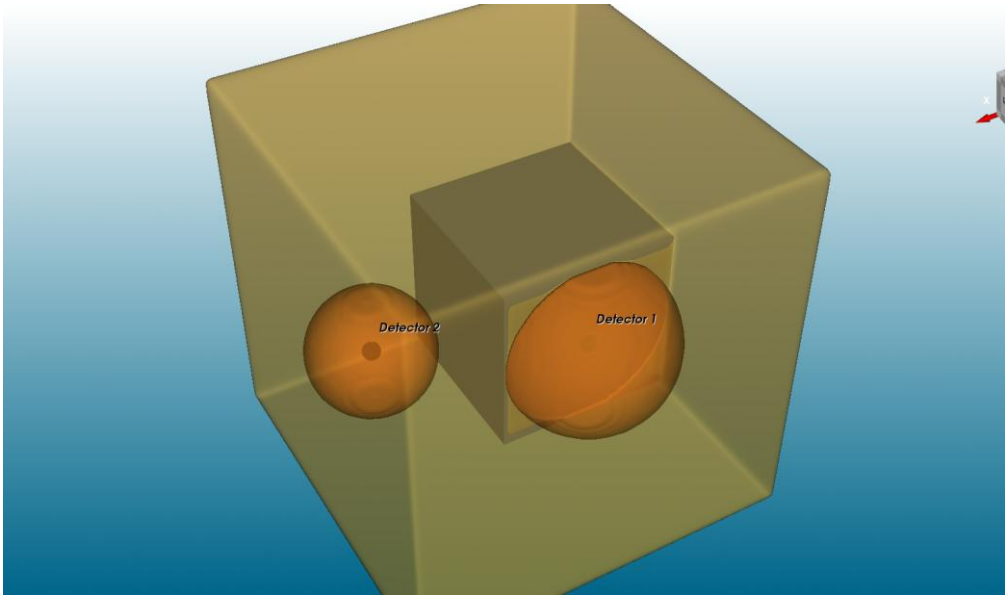
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade C - 10 m
Point Gas Detector (PGD)	H2S	Grade C - 7 m

Coverage Results

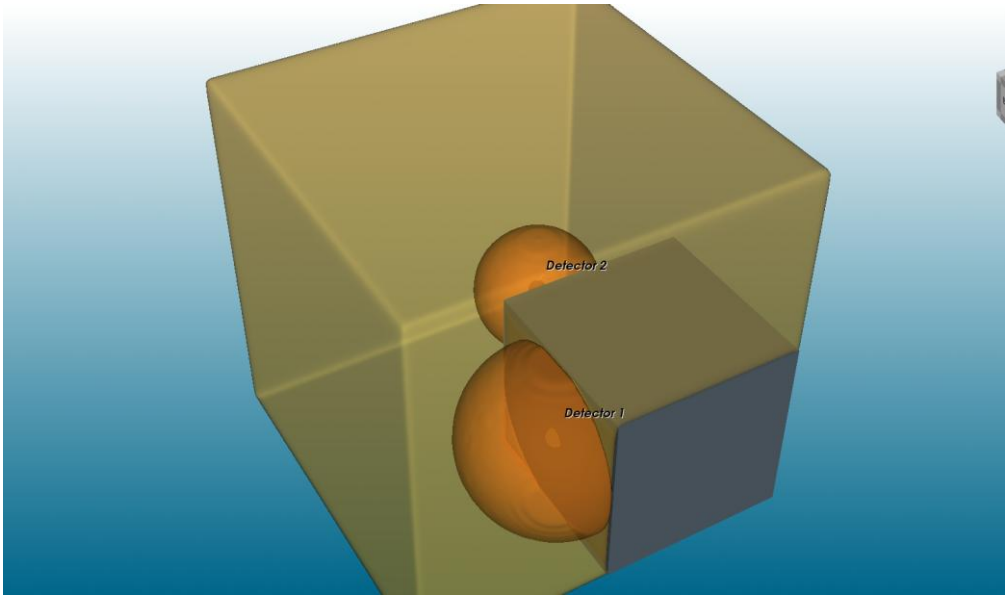
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	6.31	6.24	0.07



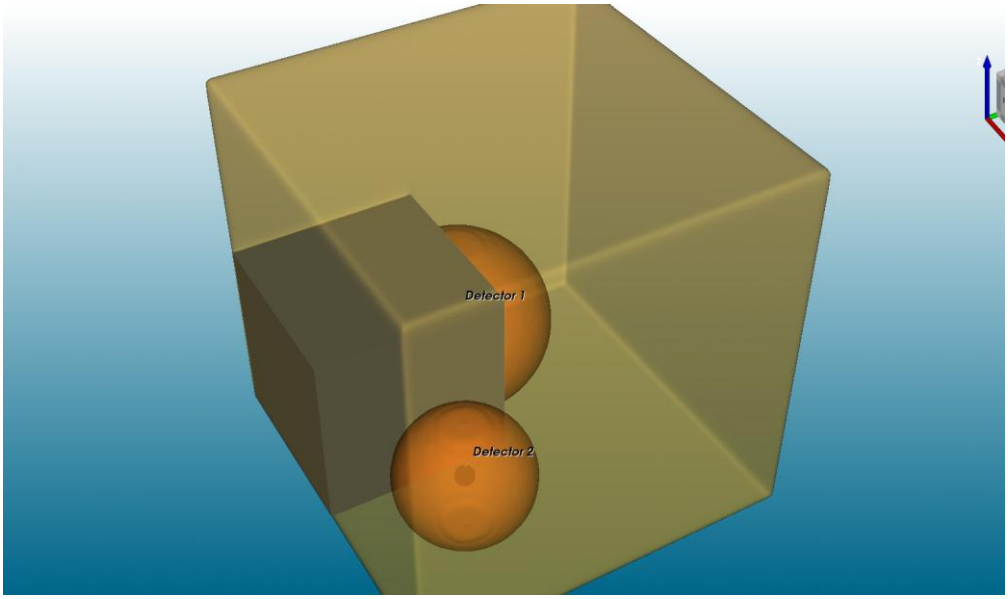
View 1



View 2



View 3



View 4

5.6.4 One HC PGD and one H2S PGD with their FOI overlapping and completely inside a cubical grade but outside the geometry. 2ooN coverage assessed.

Risk Grades

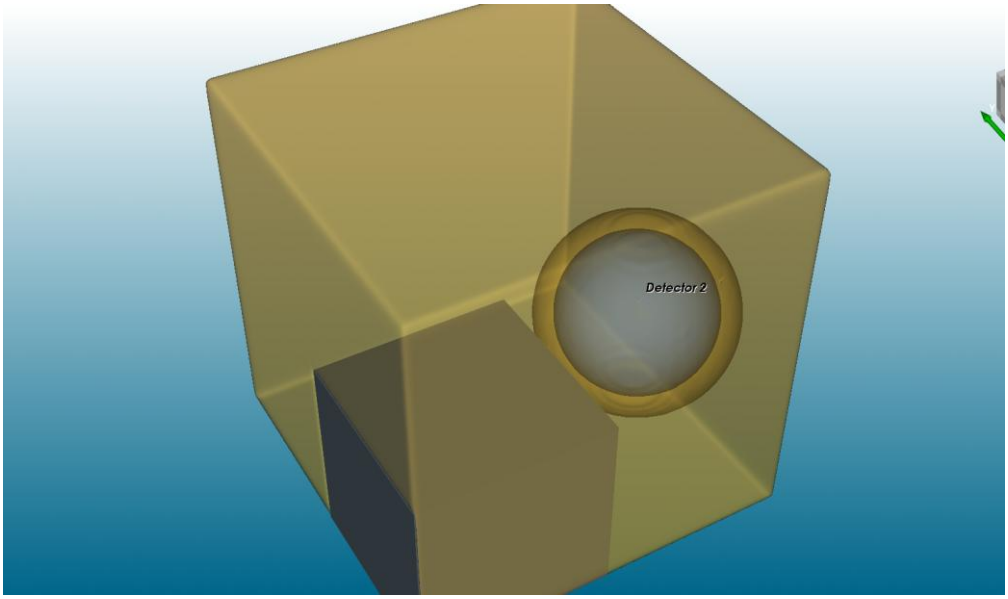
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

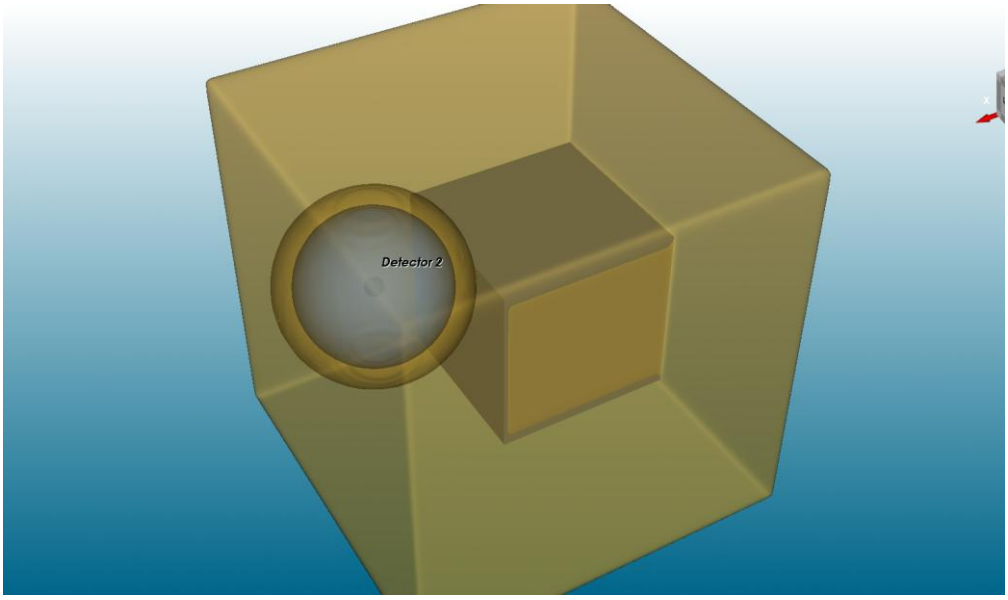
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - 10 m
Point Gas Detector (PGD)	H2S	Grade D - 8 m

Coverage Results

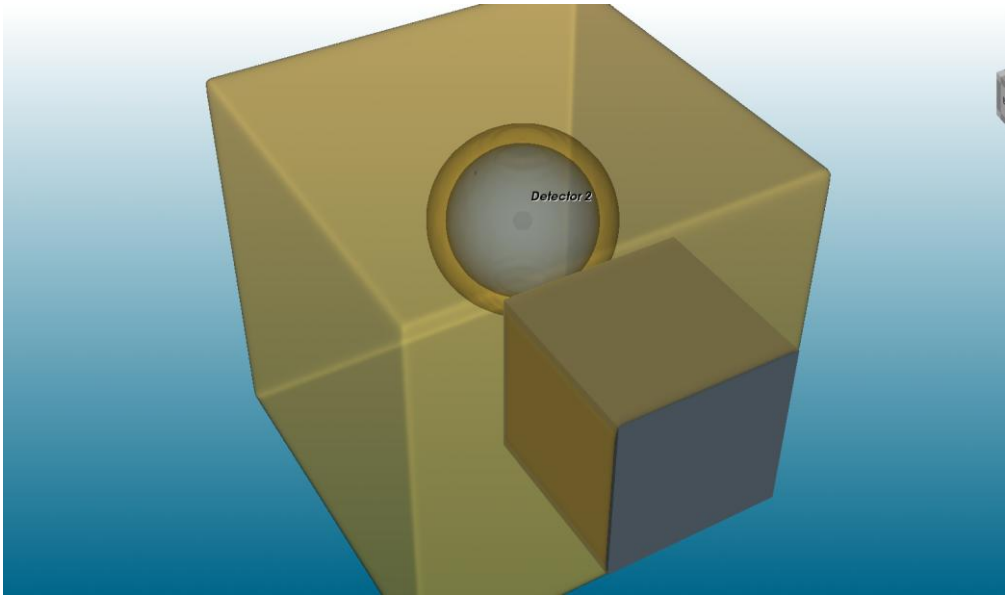
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	2ooN	3.83	3.8	0.03



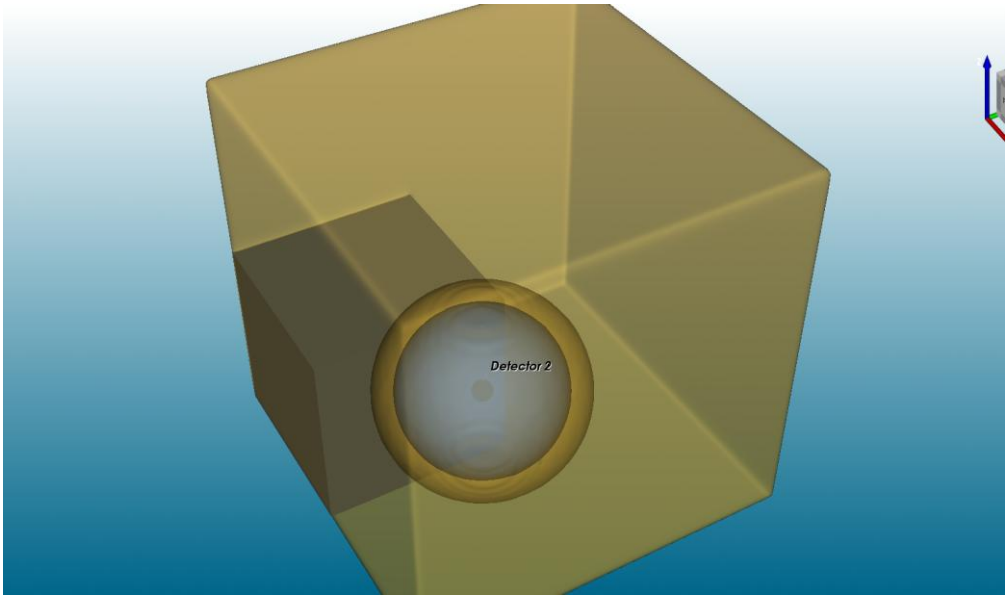
View 1



View 2



View 3



View 4

5.6.5 One HC OPGD and one H2S OPGD with their FOI non-intersecting and completely inside a cubical grade. HC detector's FOI is outside the geometry. H2S detector's FOI is half inside the geometry.

Risk Grades

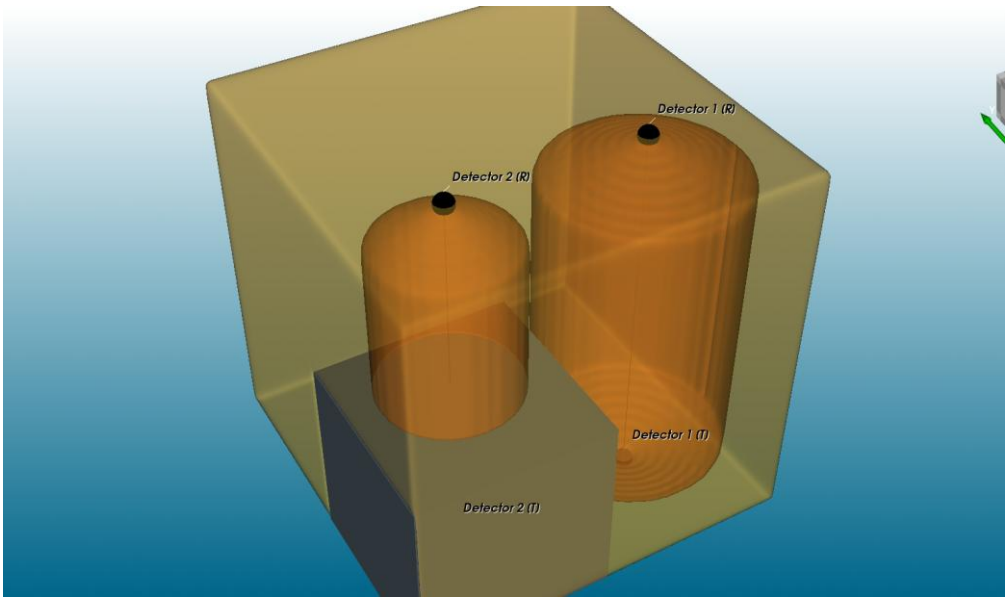
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

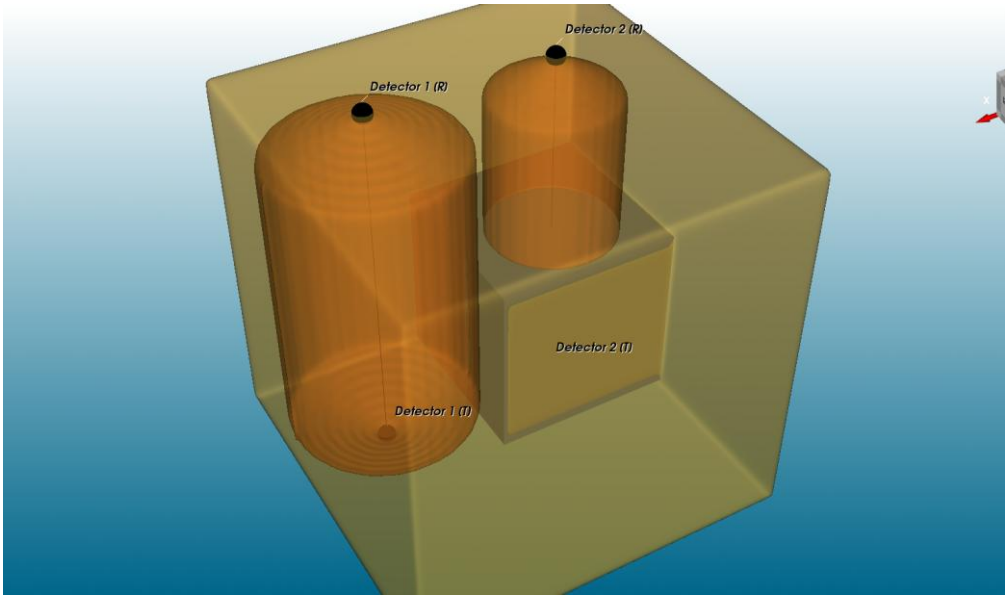
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - 10 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade D - 7 m

Coverage Results

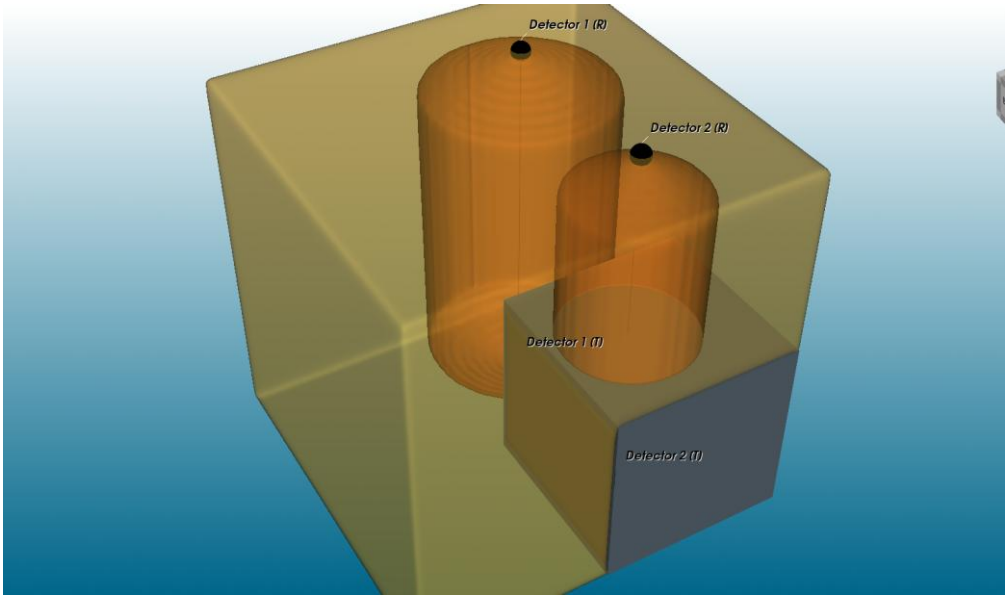
Risk Grade	Voting Logic	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	24.21	24.17	0.04



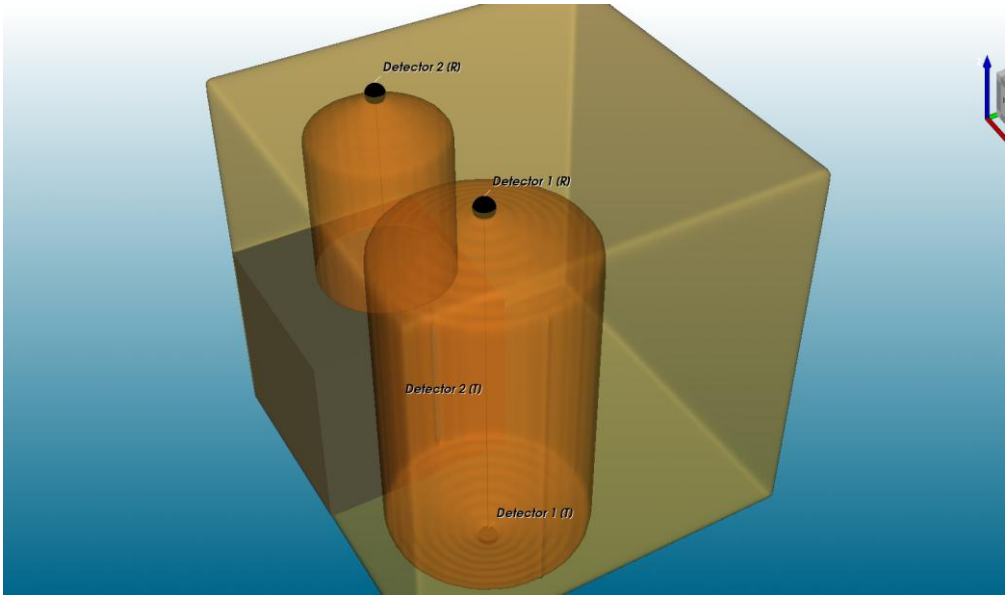
View 1


Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

View 2


Detector 1 (R)
Detector 2 (R)
Detector 1 (T)
Detector 2 (T)

View 3



View 4

6 Using High and Low Alarm Geographical Coverage Calculation

6.1 Single Grade

6.1.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside a cubical grade.

Risk Grades

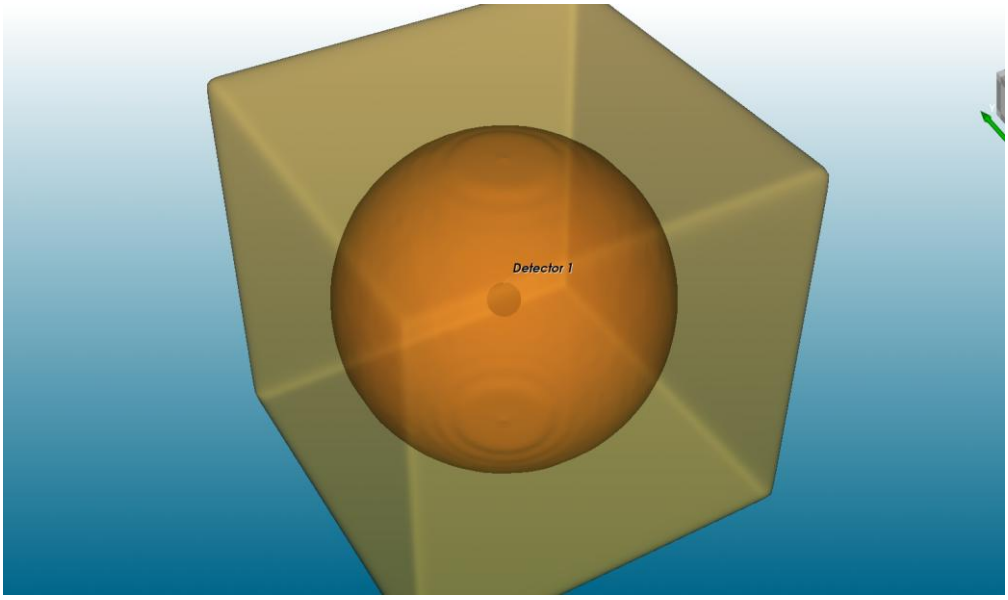
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

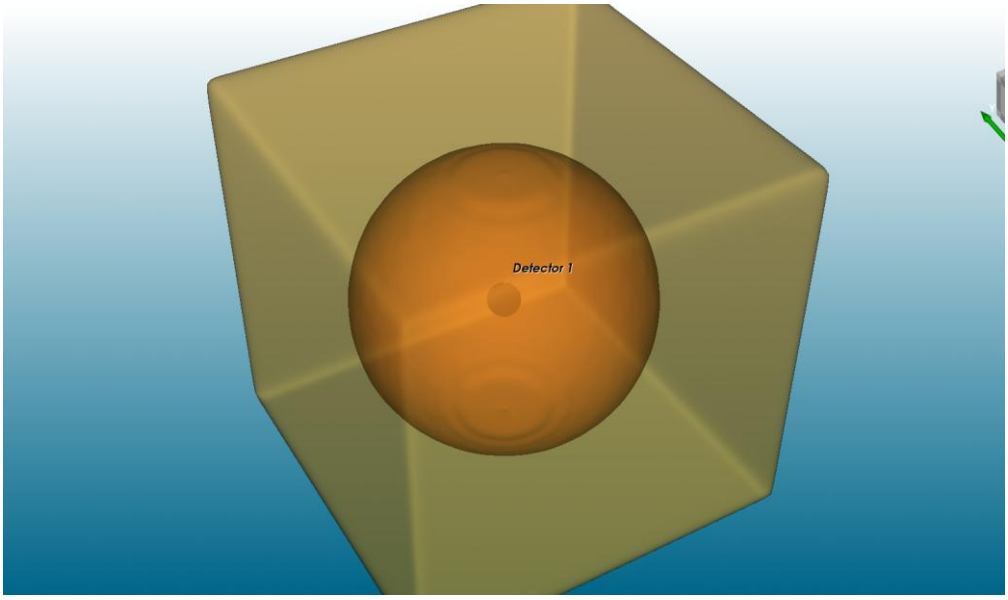
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	30.3	30.24	0.06
Grade B	1ooN	H	22.09	22.08	0.01



View 1 - L



View 1 - H

6.1.2 Two PGDs with non-interacting (FOI) completely inside a cubical grade.

Risk Grades

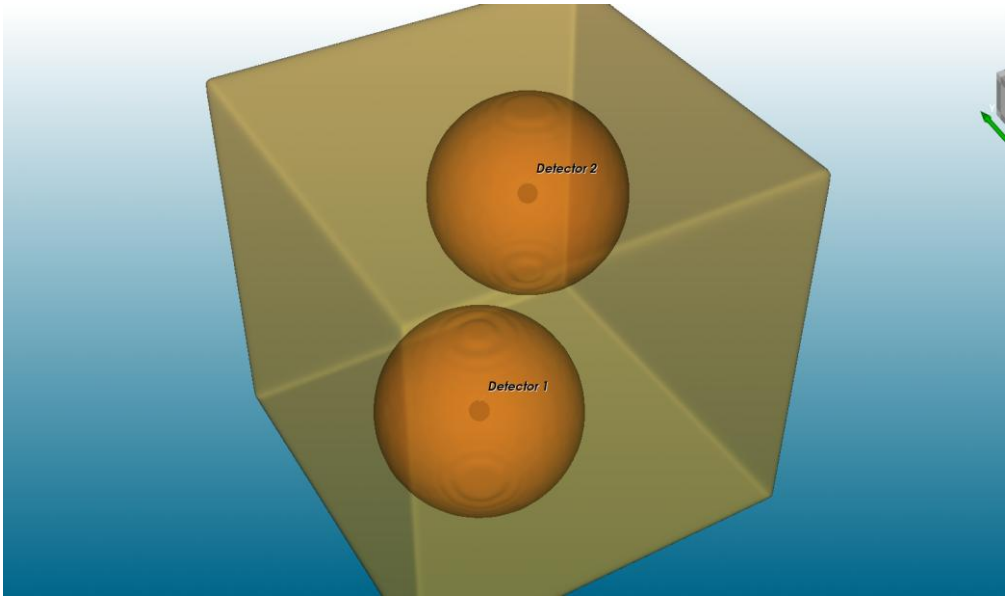
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

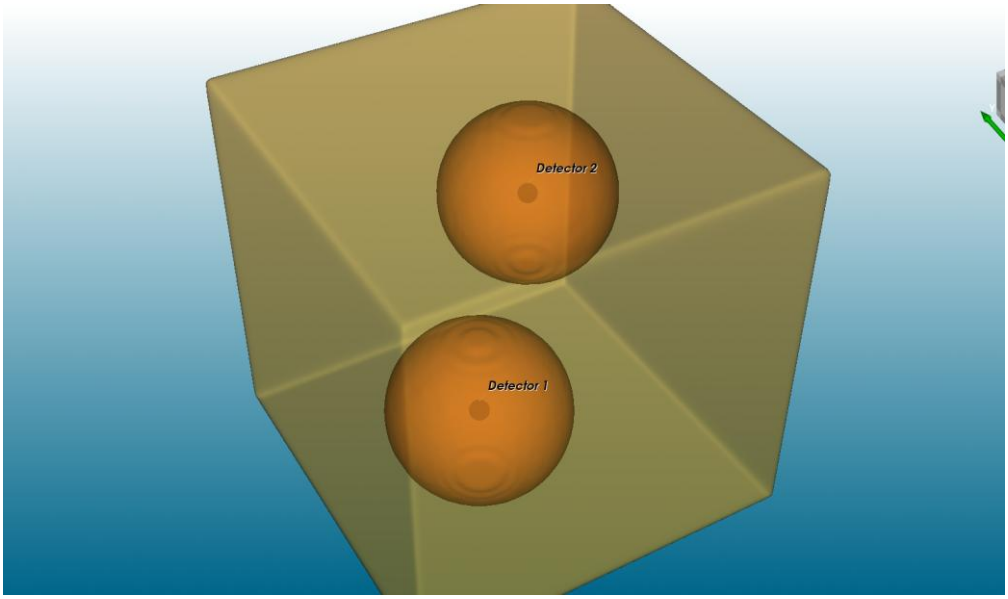
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 9 m
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	13.11	13.09	0.02
Grade B	1ooN	H	9.54	9.54	0.00



View 1 - L



View 1 - H

6.1.3 Two PGDs with one detector located at the edge of the FOI of the other detector. Cubical Grade used. 2ooN coverage assessed.

Risk Grades

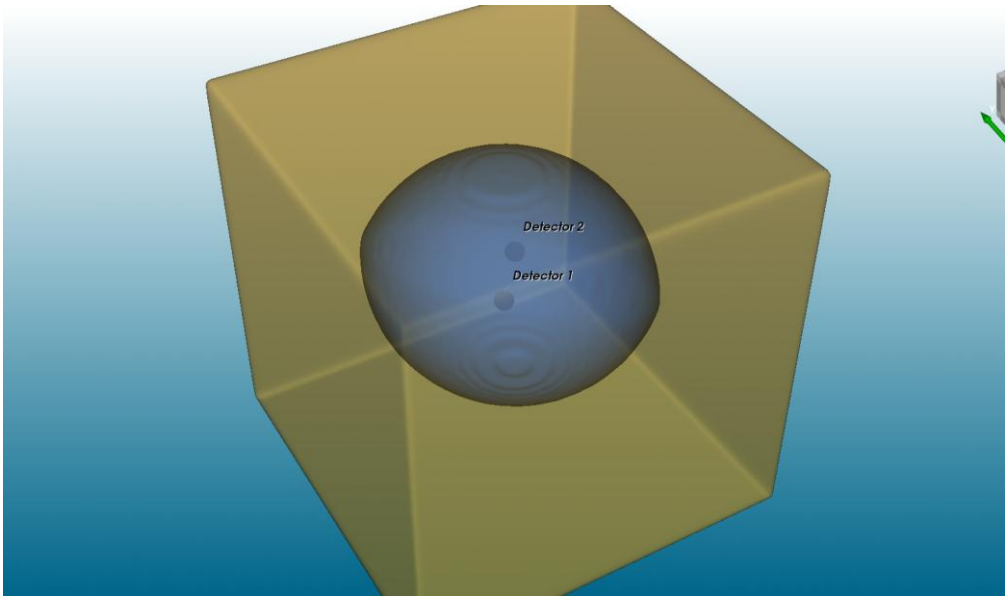
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

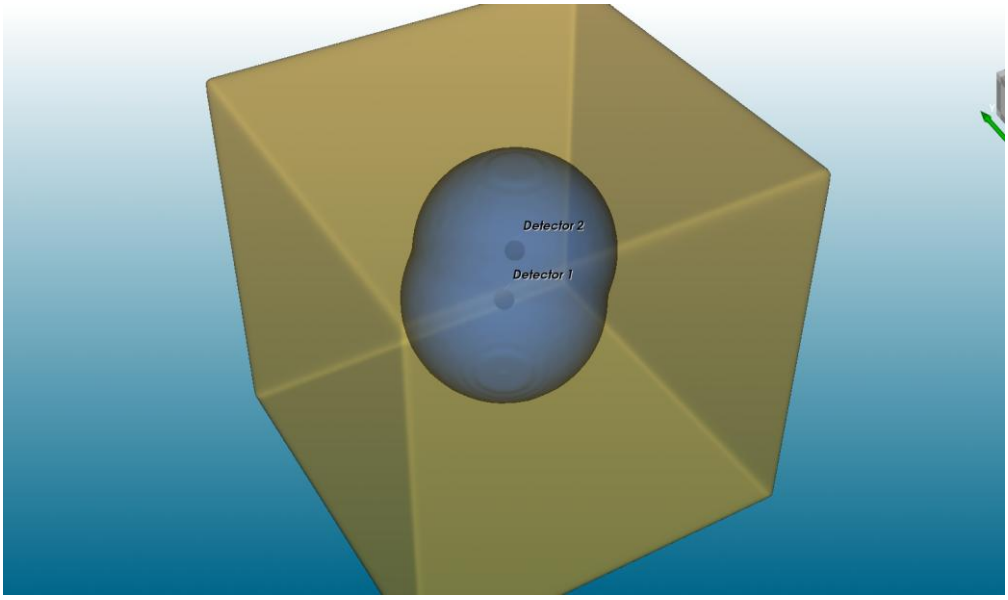
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 15 m / High 10 m
Point Gas Detector (PGD)	HC	Grade B - Low 15 m / High 10 m

Coverage Results

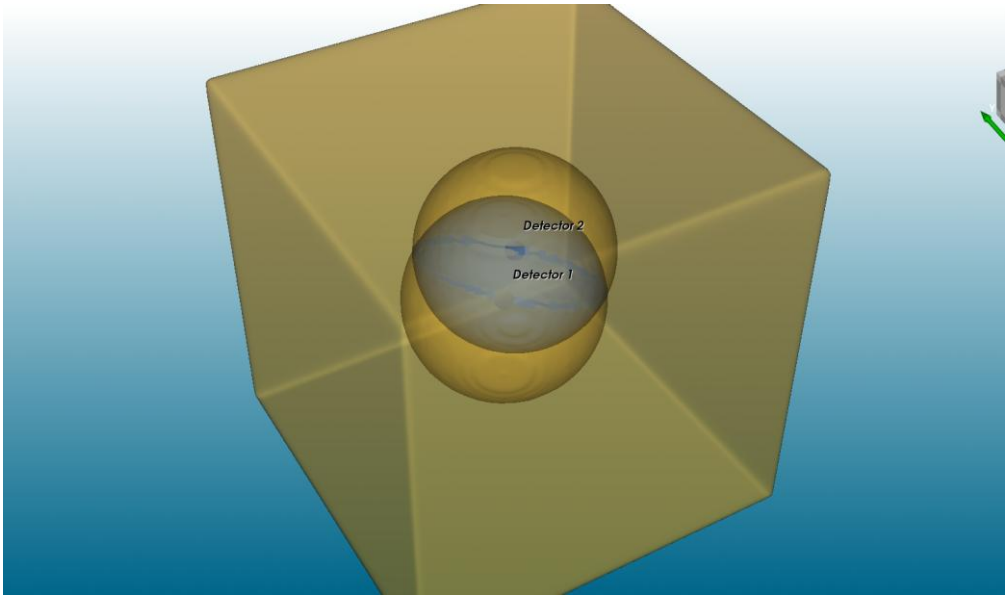
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	LL	16.62	16.61	0.01
Grade B	2ooN	LH	8.95	8.94	0.01
Grade B	2ooN	HH	4.14	4.14	0.00



View 1 - LL



View 1 - LH



View 1 - HH

6.1.4 One PGD located at the edge of a cubical grade. Exactly half portion of detector's FOI is outside the grade.

Risk Grades

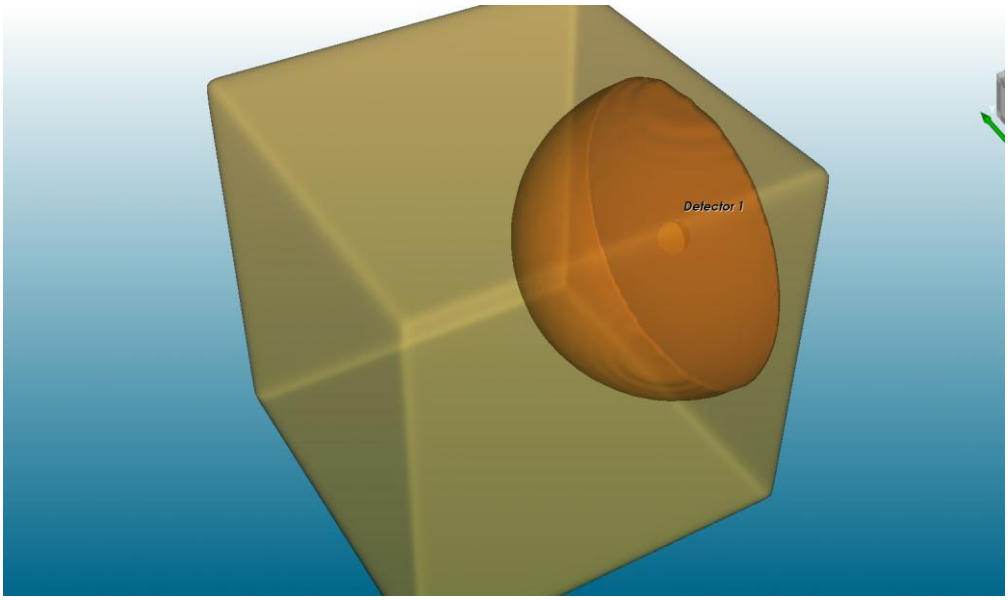
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

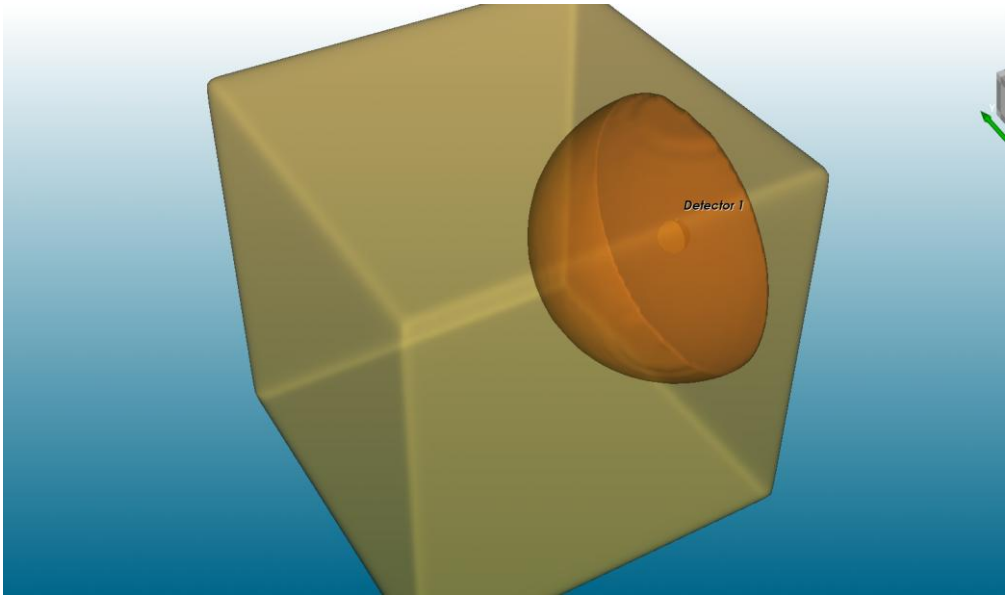
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	15.15	15.12	0.03
Grade B	1ooN	H	11.04	11.04	0.00



View 1 - L



View 1 - H

6.1.5 One Open Path Gas Detector (OPGD) with its FOI completely inside a cubical grade.

Risk Grades

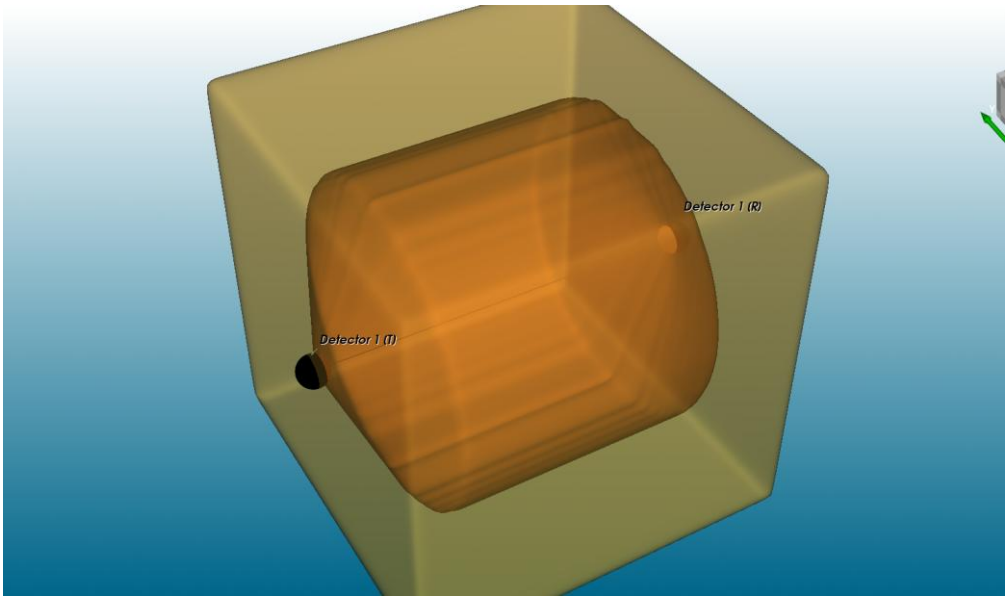
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

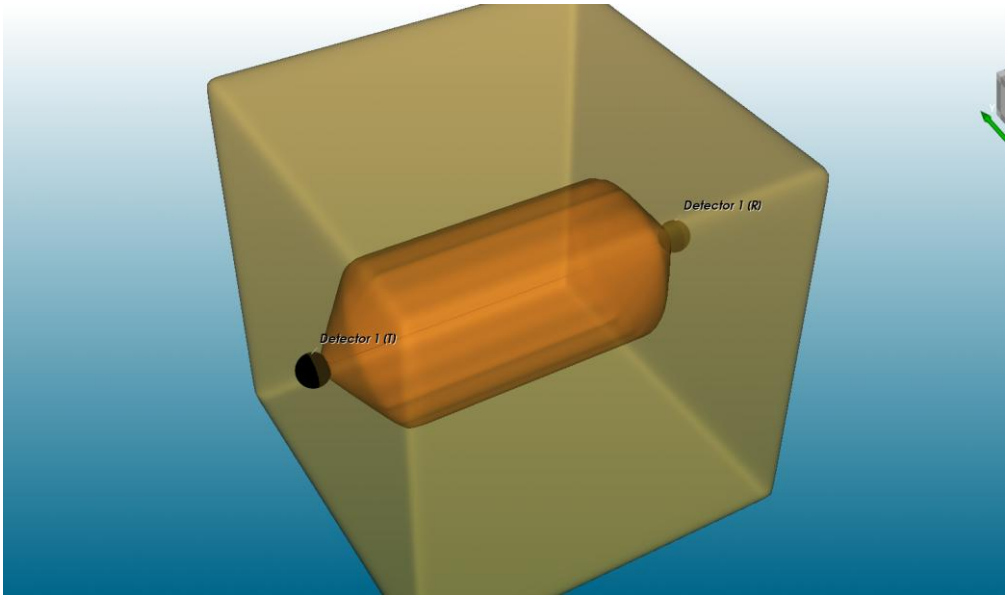
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	12 m	Grade B - Low 10 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	42.42	42.18	0.24
Grade B	1ooN	H	10.61	10.48	0.13



View 1 - L



View 1 - H

6.1.6 Two OPGDs perpendicular to each other in a cubical grade

Risk Grades

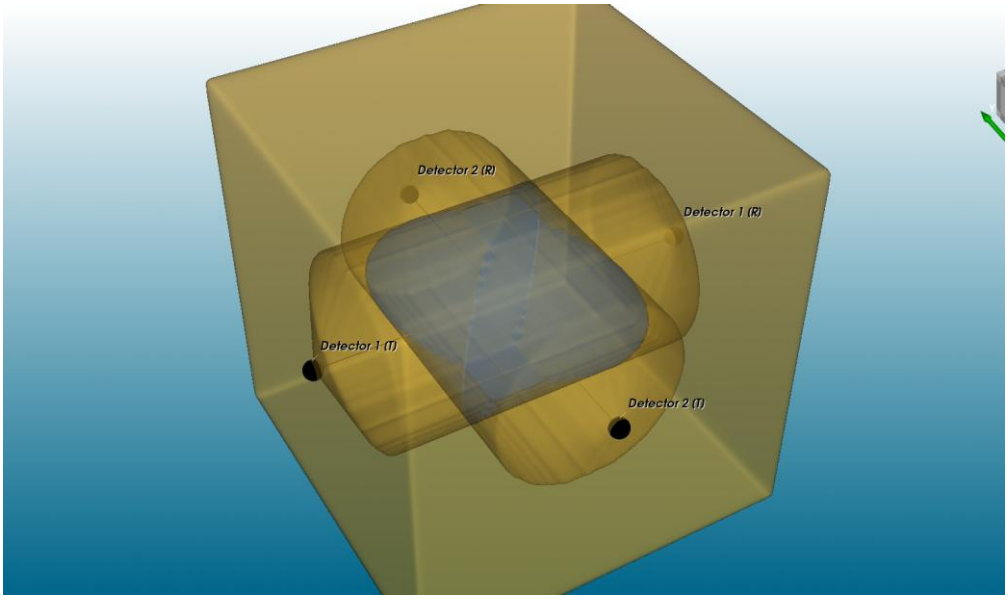
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

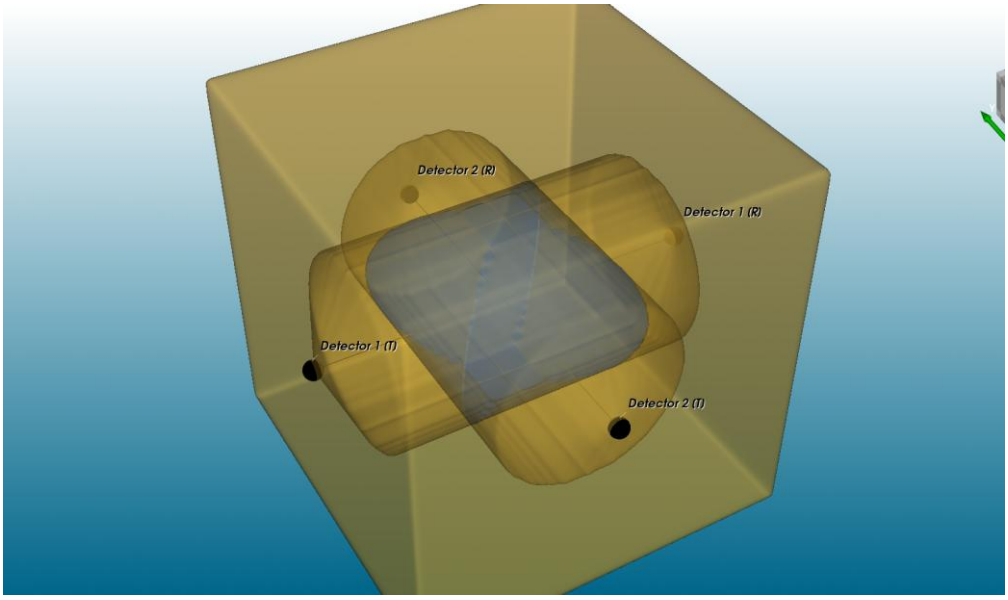
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 10 m

Coverage Results

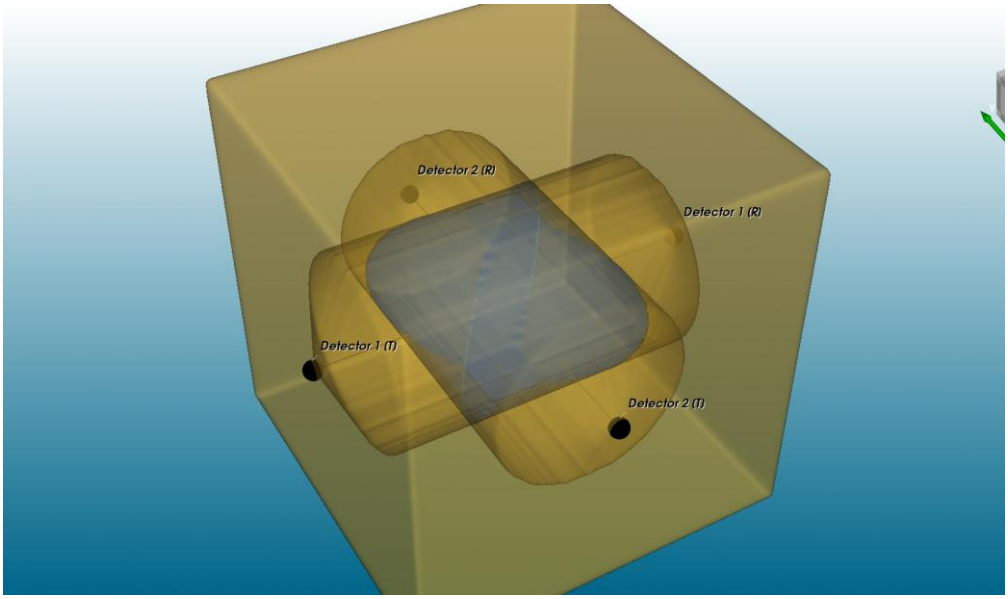
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	LL	8.33	8.29	0.04
Grade C	2ooN	LH	8.33	8.29	0.04
Grade C	2ooN	HH	8.33	8.29	0.04



View 1 - LL



View 1 - LH



View 1 - HH

6.1.7 Two OPGDs parallel to each other in a cubical grade.

Risk Grades

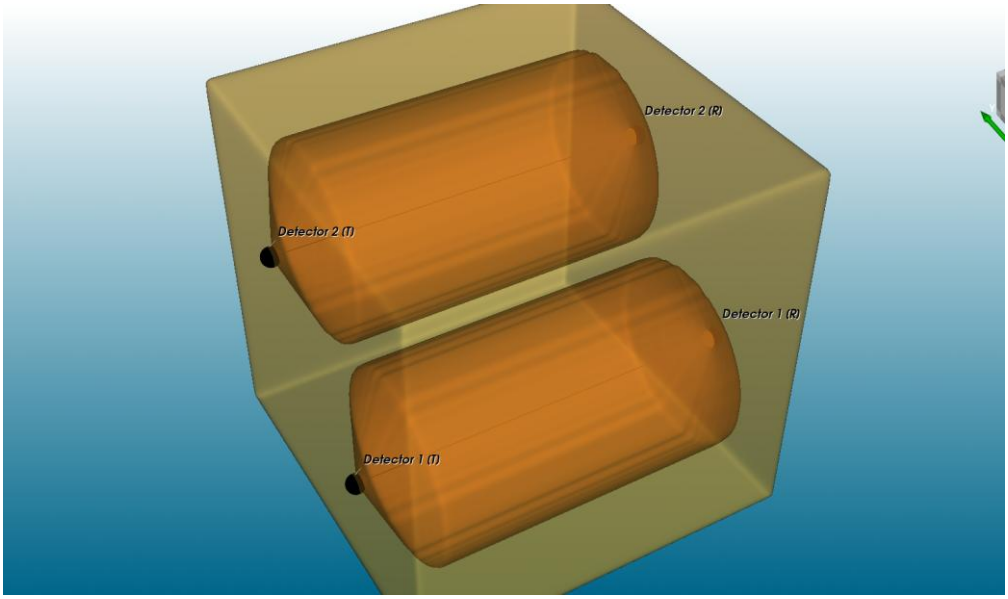
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

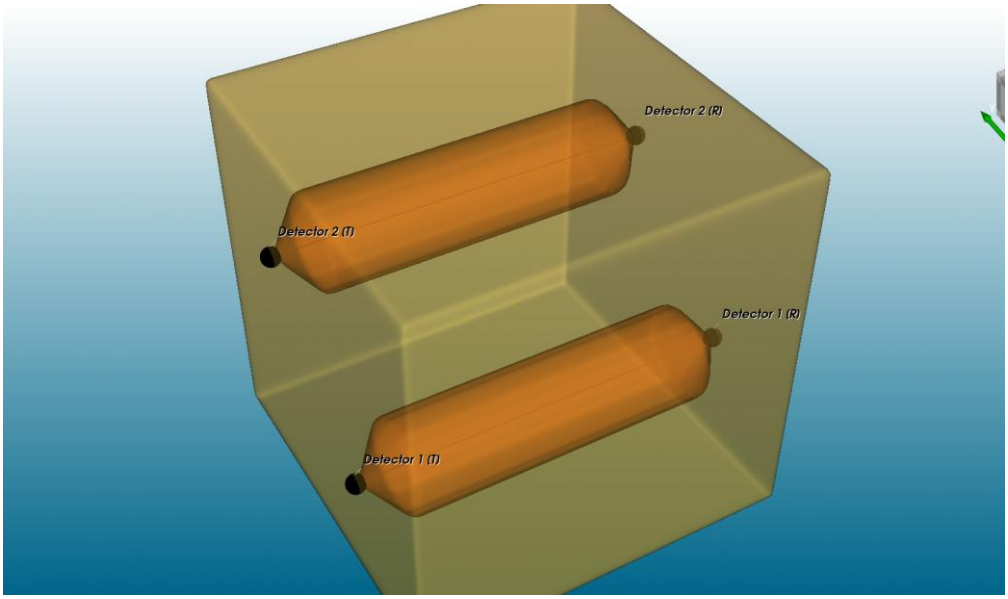
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - Low 10 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	34.03	34.08	0.05
Grade A	1ooN	H	8.51	8.55	0.04



View 1 - L



View 1 - H

6.1.8 One OPGD with half of FOI outside the cubical grade.

Risk Grades

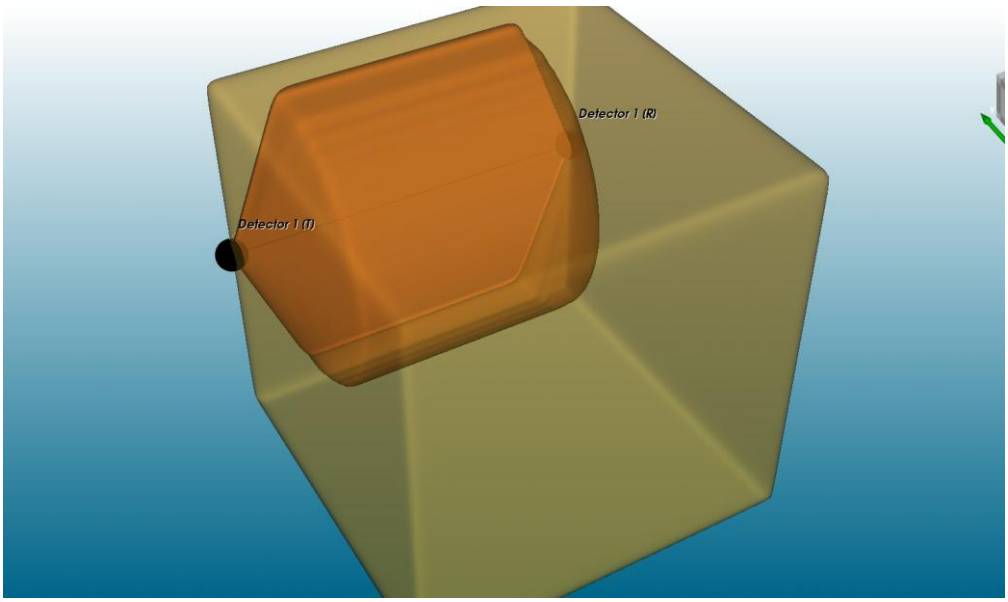
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D

Gas Detectors

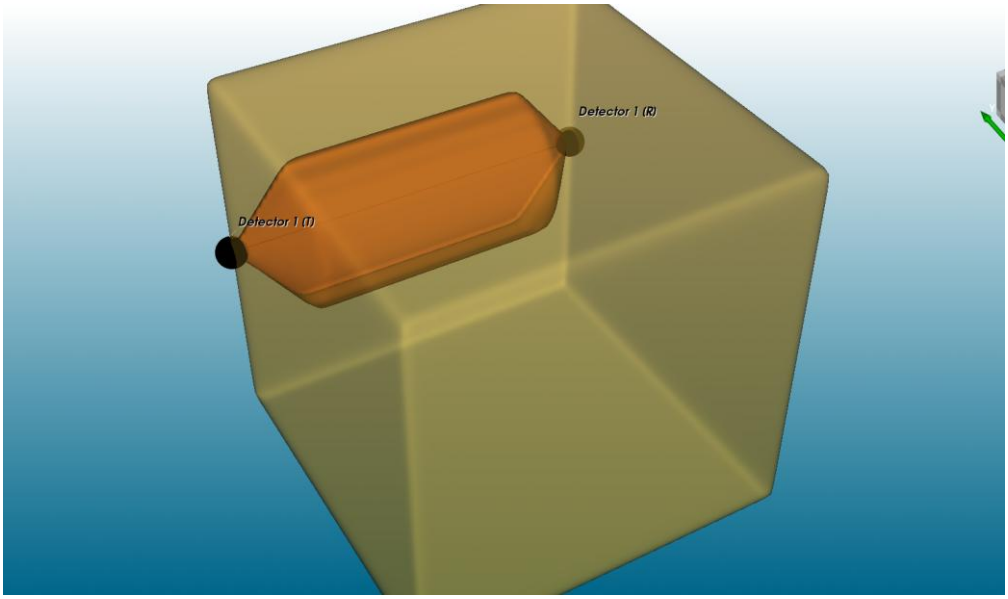
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	12 m	Grade D - Low 10 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	21.21	21.09	0.12
Grade D	1ooN	H	5.31	5.24	0.07



View 1 - L



View 1 - H

6.1.9 One OPGD and one PGD with non-intersecting FOIs inside a cubical grade.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

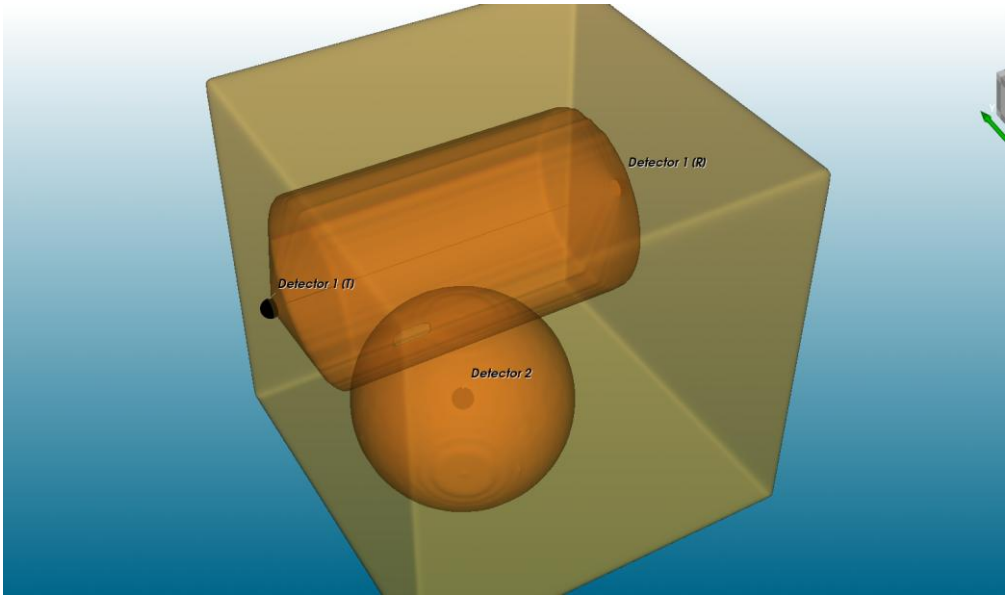
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 5 m
Point Gas Detector (PGD)	HC	-	Grade C - Low 10 m / High 5 m

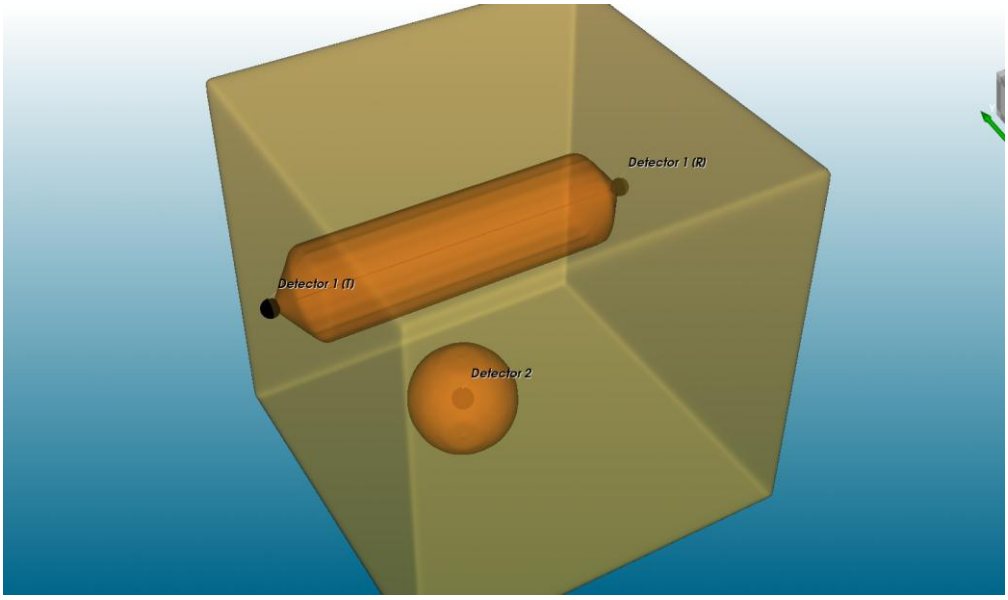
Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	23.56	23.46	0.10
Grade C	1ooN	H	5.07	5.02	0.05

Note: Best-effort placement — an OPGD spanning the full grade width leaves no room for a point detector to be both fully contained and non-overlapping (see geometry.mjs module note). Expect a larger deviation here than the doc's original.



View 1 - L



View 1 - H

6.1.10 One OPGD and one PGD with overlapping FOIs inside a cubical grade. 2ooN coverage assessed.

Risk Grades

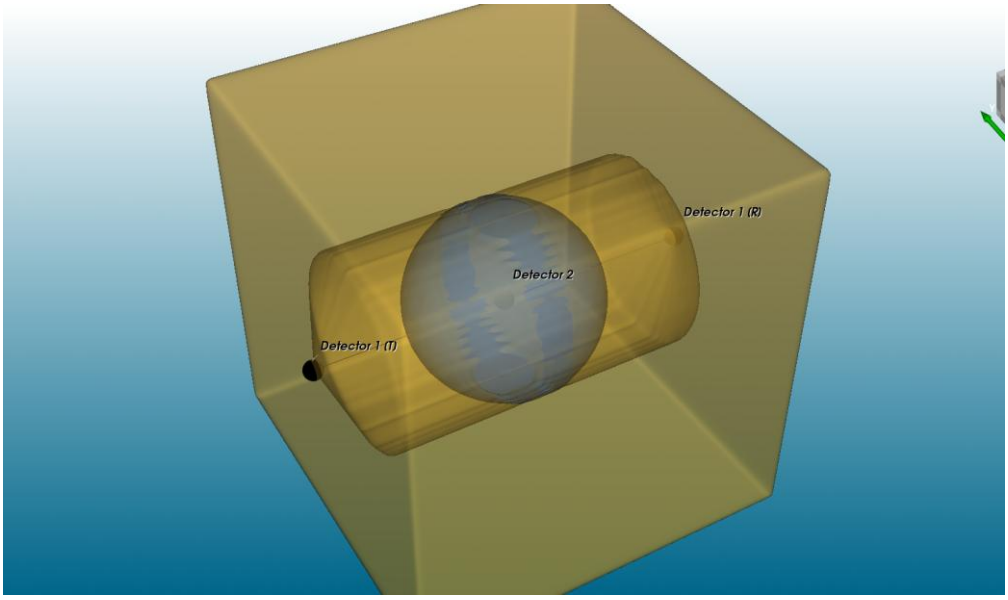
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

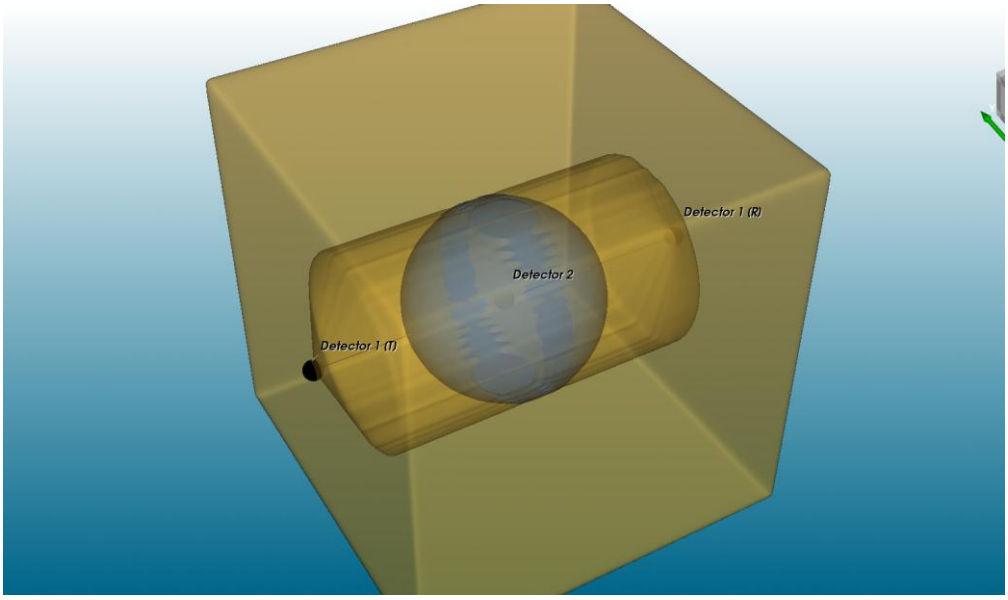
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - Low 10 m / High 10 m
Point Gas Detector (PGD)	HC	-	Grade A - Low 10 m / High 10 m

Coverage Results

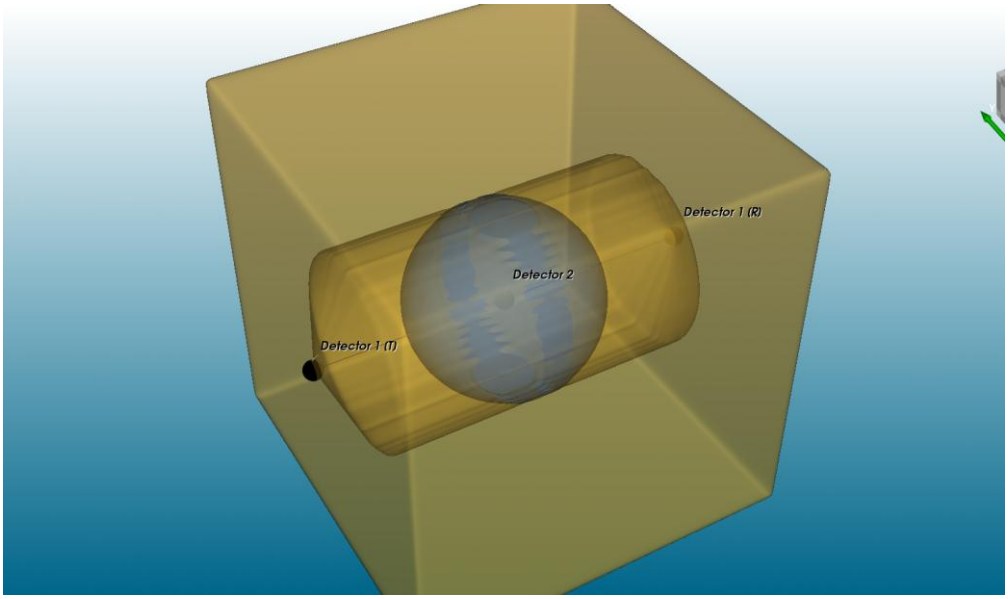
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	2ooN	LL	6.54	6.53	0.01
Grade A	2ooN	LH	6.54	6.53	0.01
Grade A	2ooN	HH	6.54	6.53	0.01



View 1 - LL



View 1 - LH



View 1 - HH

6.1.11 Two OPGDs parallel to each other and overlapping FOI inside a cubical grade. 2ooN coverage assessed.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

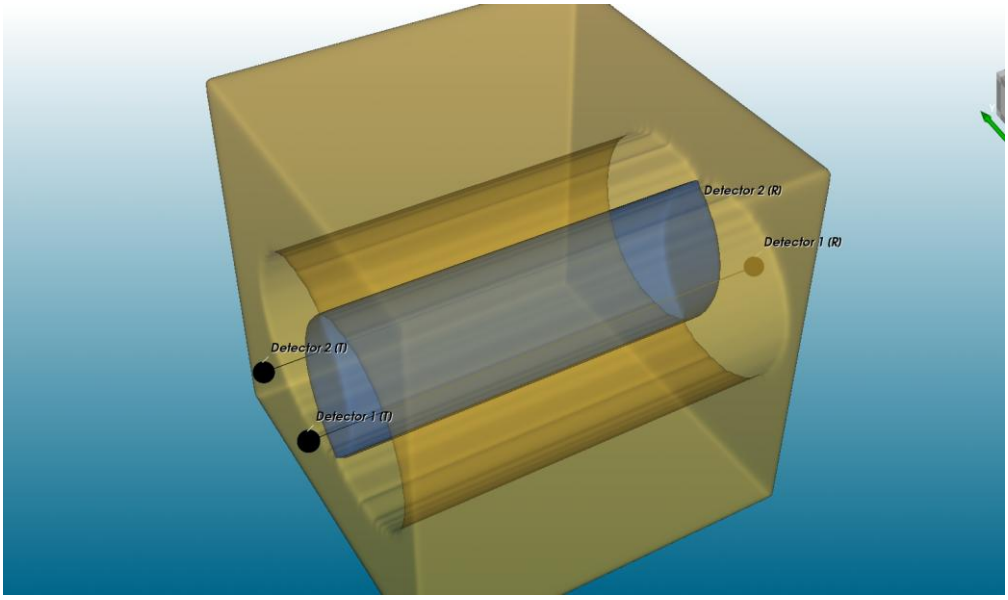
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	24 m	Grade B - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	HC	24 m	Grade B - Low 10 m / High 10 m

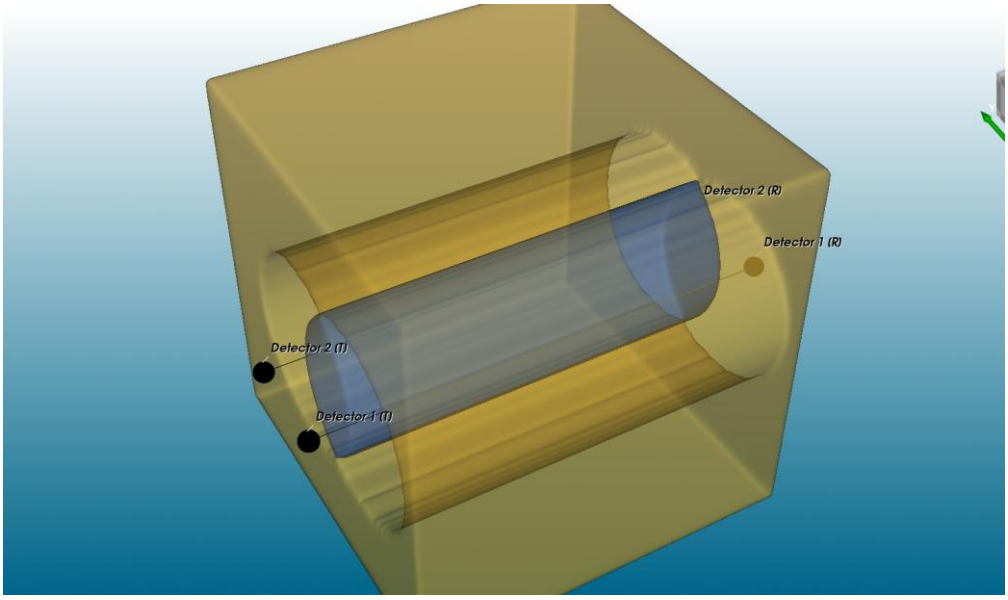
Analytical Formula: $(1.228 \times R^2 \times (\text{Range}-4)) / 40$

Coverage Results

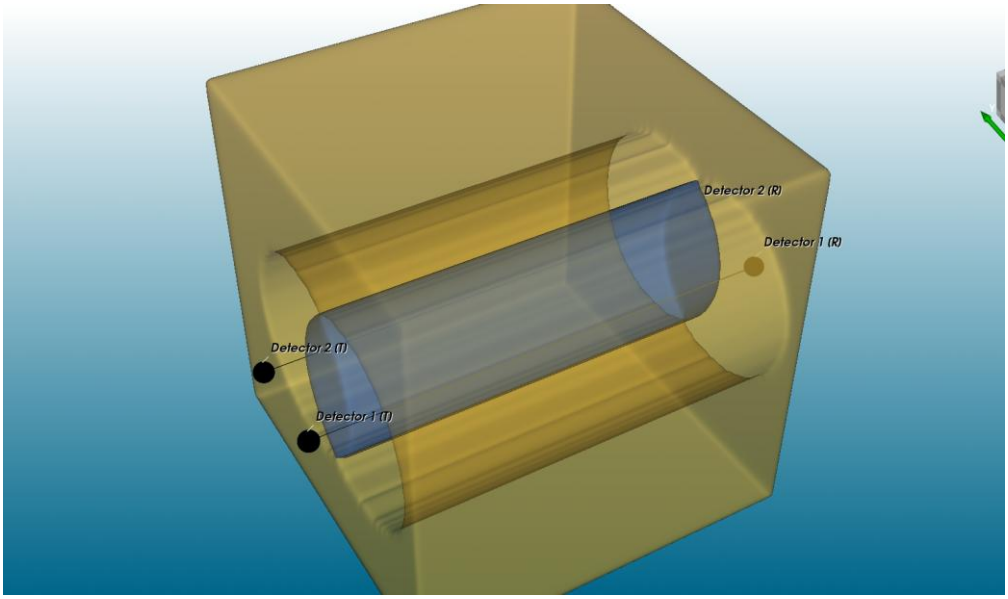
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	LL	7.67	7.66	0.01
Grade B	2ooN	LH	7.67	7.66	0.01
Grade B	2ooN	HH	7.67	7.66	0.01



View 1 - LL



View 1 - LH



View 1 - HH

6.1.12 One PGD with its FOI completely inside a cylindrical grade.

Risk Grades

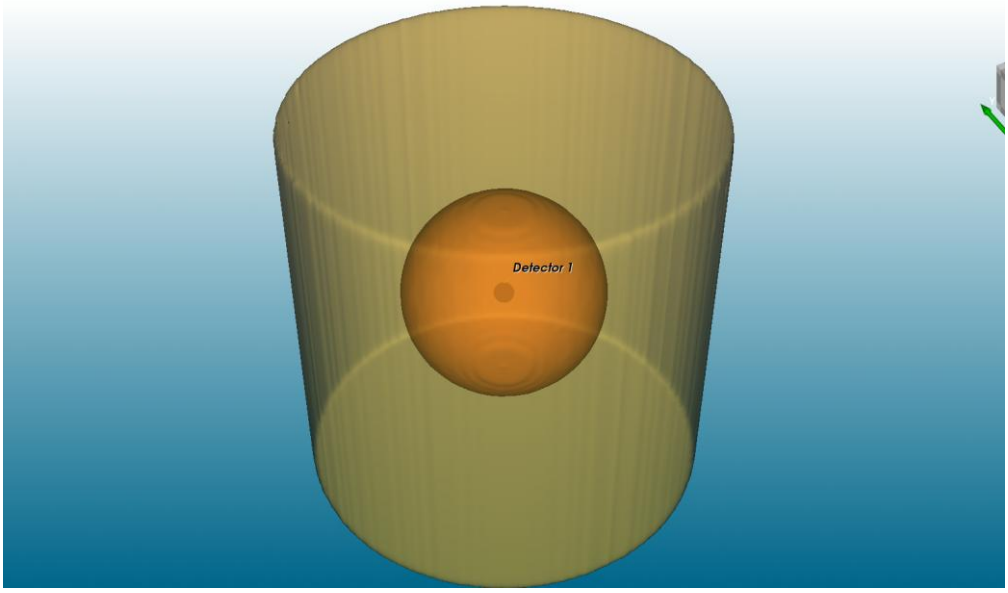
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade B

Gas Detectors

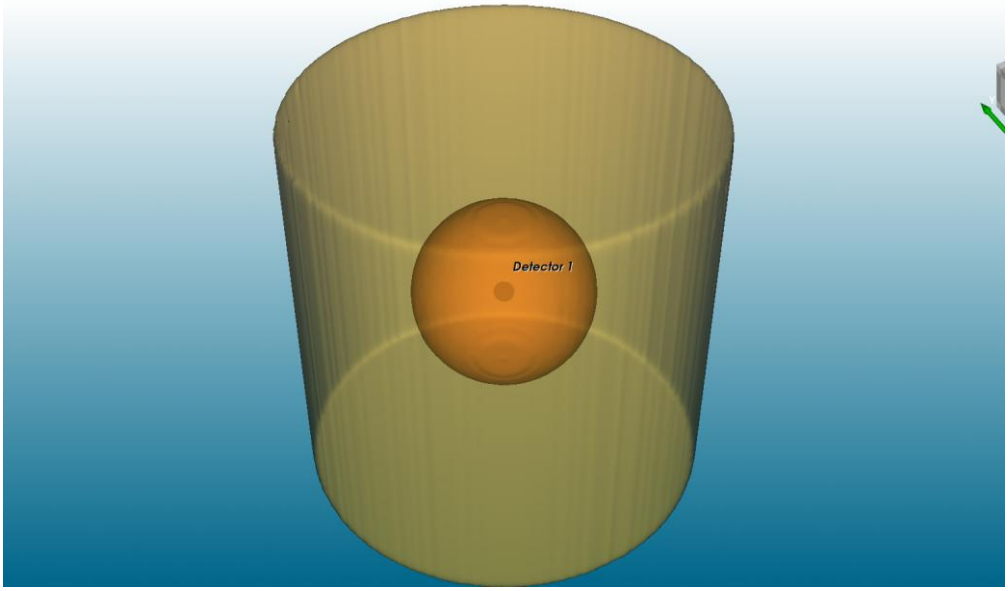
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	8.33	8.33	0.00
Grade B	1ooN	H	6.08	6.08	0.00



View 1 - L



View 1 - H

6.2 Two Grades of One Type

6.2.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside each grade

Risk Grades

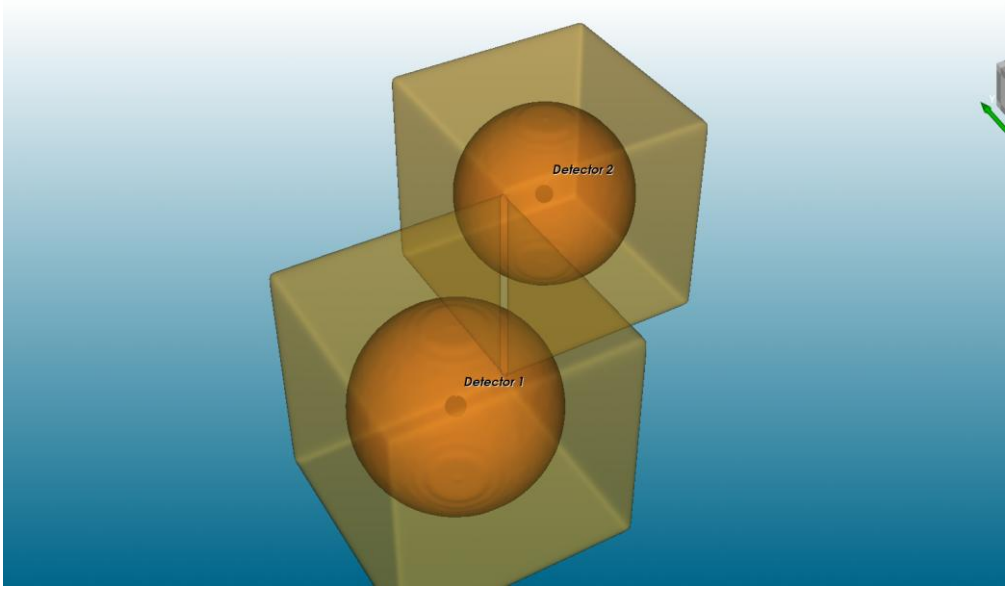
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A

Gas Detectors

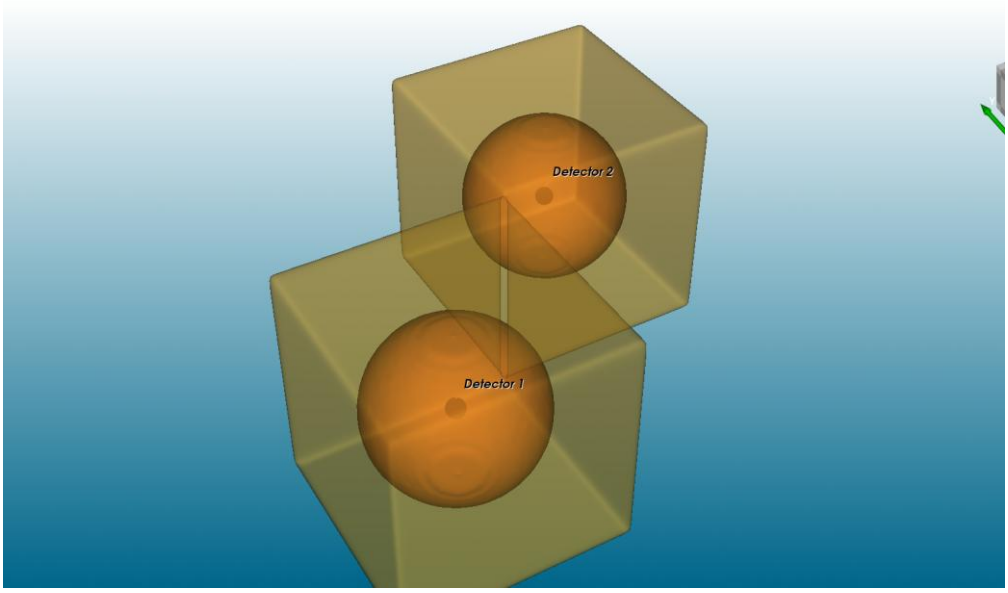
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2	Grade A - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	30.3	30.24	0.06
Grade A	1ooN	H	22.09	22.08	0.01



View 1 - L



View 1 - H

6.2.2 Two PGDs with non-interacting (FOI) completely inside each grade.

Risk Grades

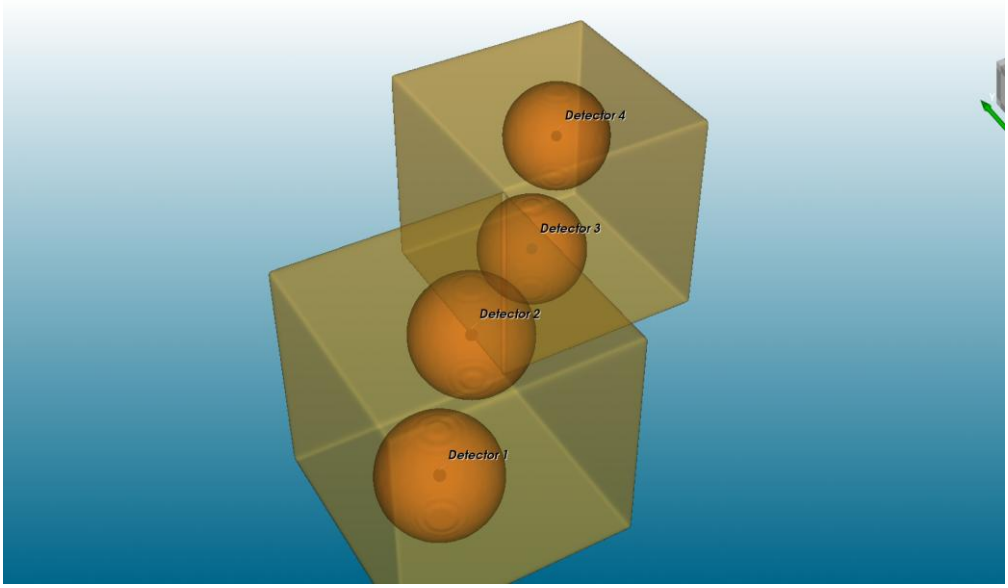
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

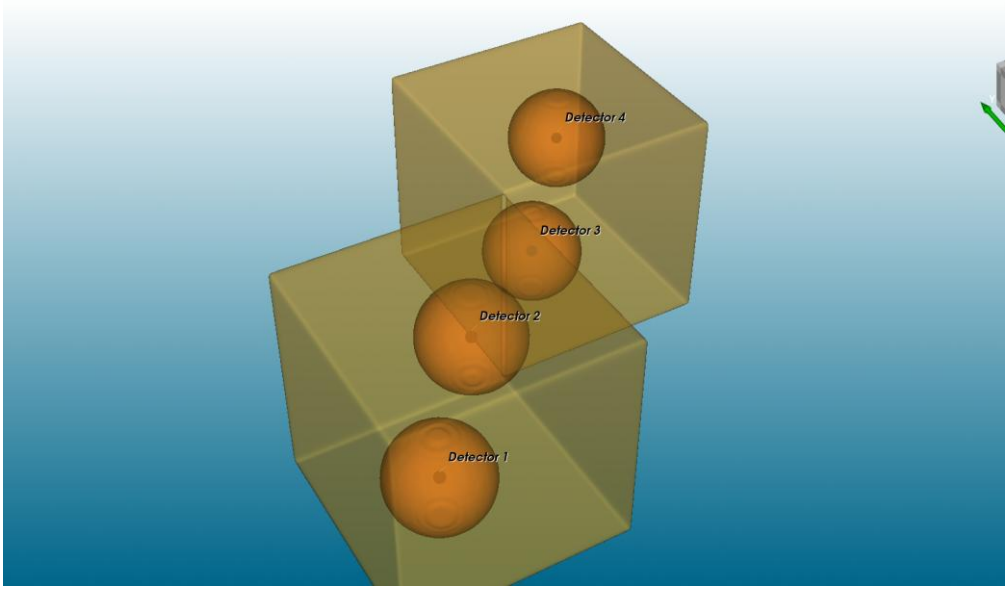
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2	Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2	Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2	Grade A - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	13.11	13.09	0.02
Grade A	1ooN	H	9.54	9.54	0.00



View 1 - L



View 1 - H

6.2.3 Two PGDs inside each grade with one detector located at the edge of the FOI of the other detector. 2 Cubical Grades used. 2ooN coverage assessed.

Risk Grades

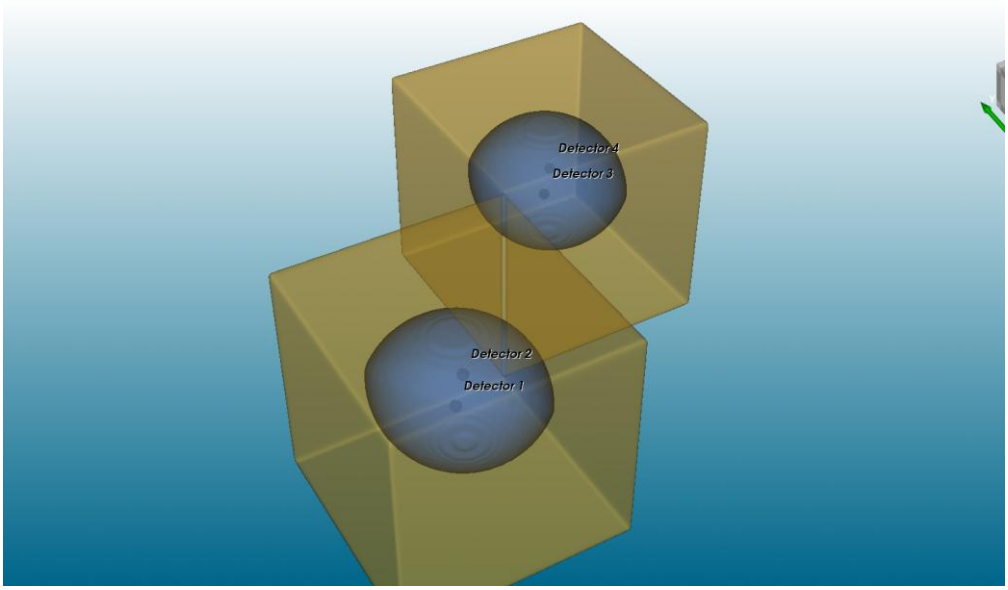
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

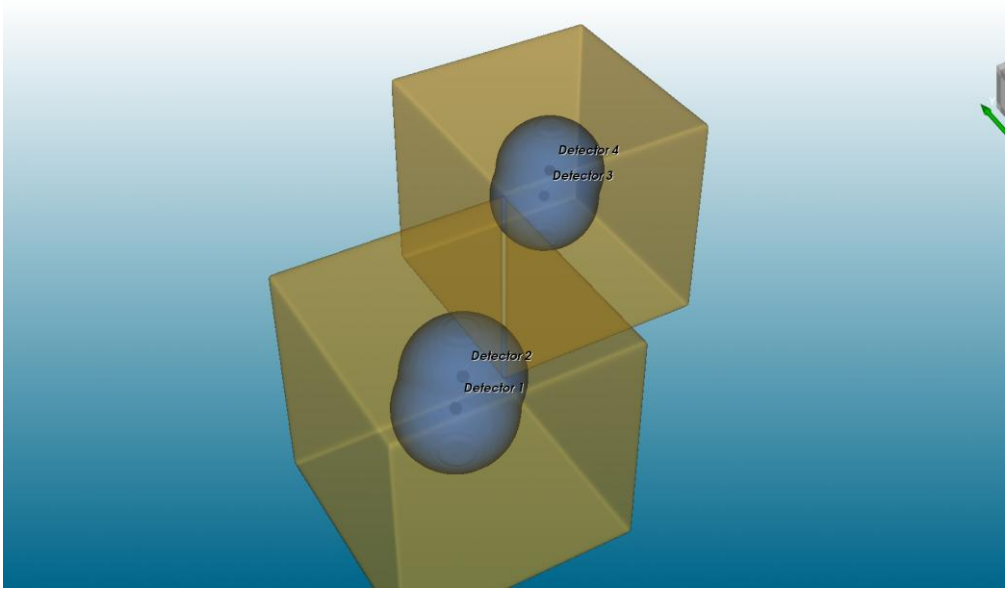
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade A - Low 15 m / High 10 m
Point Gas Detector (PGD)	H2	Grade A - Low 15 m / High 10 m
Point Gas Detector (PGD)	H2	Grade A - Low 15 m / High 10 m
Point Gas Detector (PGD)	H2	Grade A - Low 15 m / High 10 m

Coverage Results

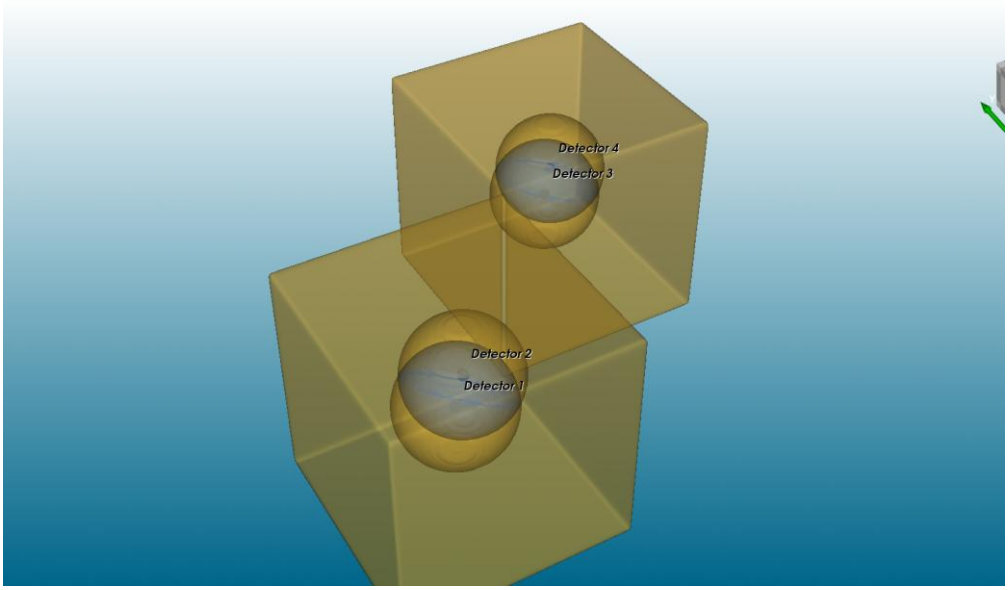
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	2ooN	LL	16.62	16.61	0.01
Grade A	2ooN	LH	8.95	8.94	0.01
Grade A	2ooN	HH	4.14	4.14	0.00



View 1 - LL



View 1 - LH



View 1 - HH

6.2.4 One PGD located at the edge of each cubical grade. Exactly half portion of detector's FOI is outside the respective grade.

Risk Grades

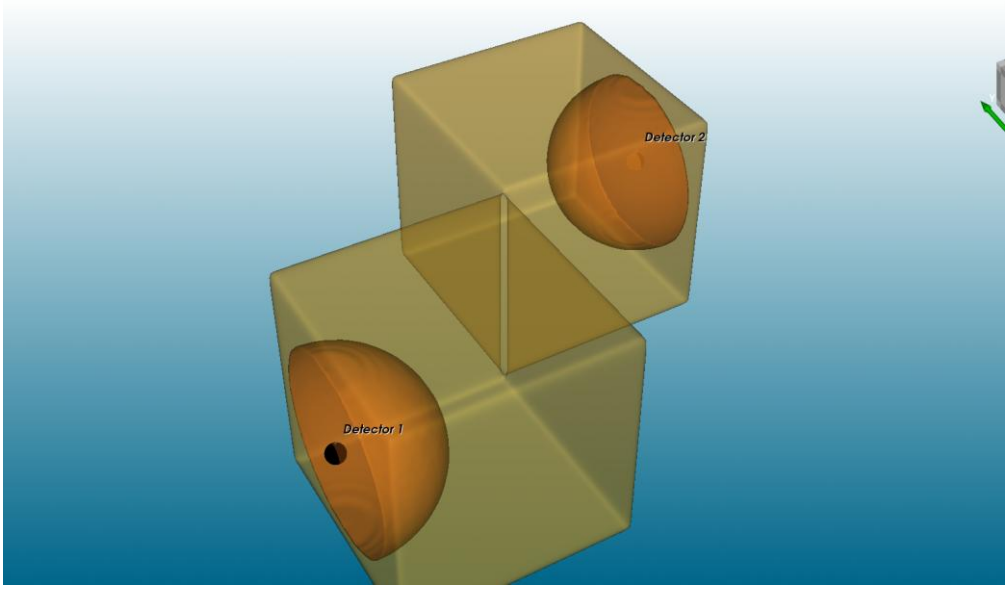
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade C
Cube	Length 12 m, Width 12 m, Height 12 m	Grade C

Gas Detectors

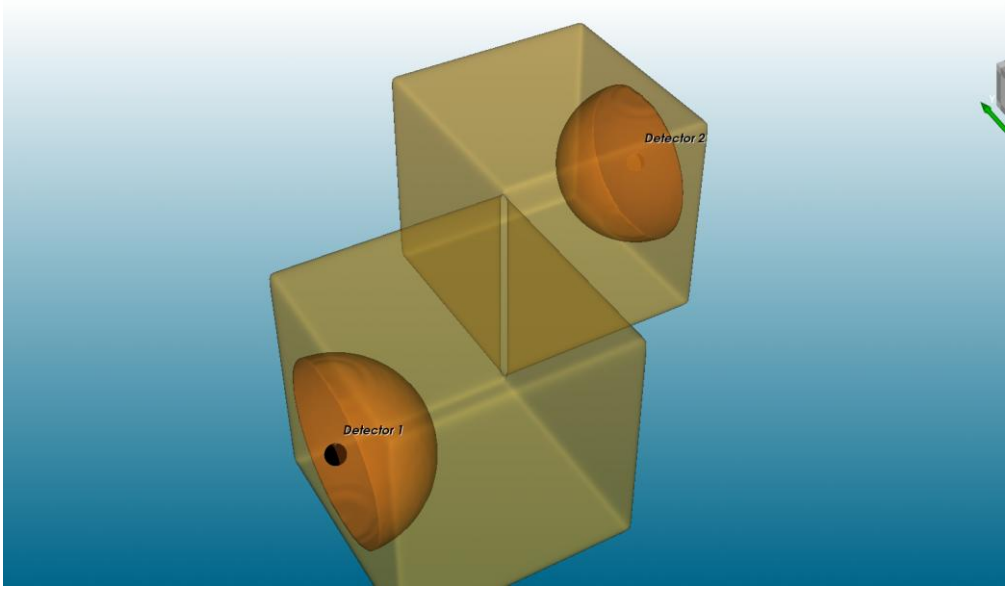
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade C - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2	Grade C - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	15.15	15.12	0.03
Grade C	1ooN	H	11.04	11.04	0.00



View 1 - L



View 1 - H

6.2.5 One Open Path Gas Detector (OPGD) with its FOI completely inside each grade.

Risk Grades

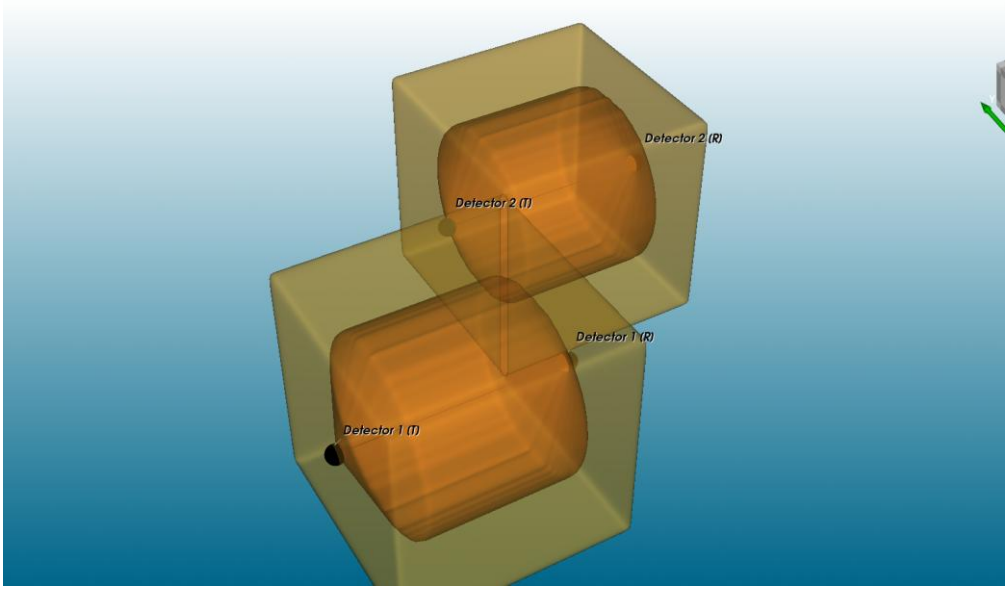
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A

Gas Detectors

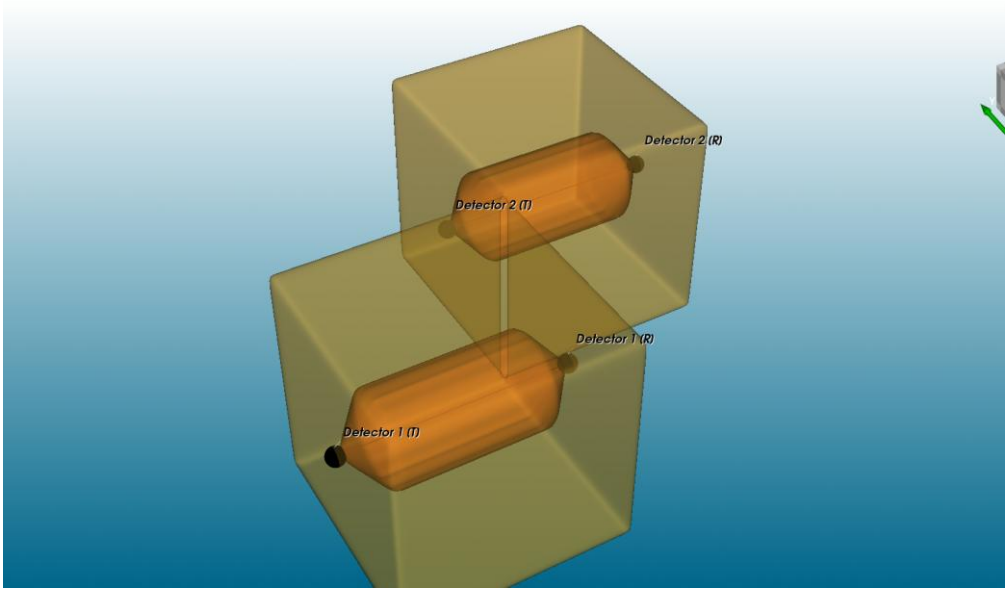
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	12 m	Grade A - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2	12 m	Grade A - Low 10 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	42.42	42.18	0.24
Grade A	1ooN	H	10.61	10.48	0.13



View 1 - L



View 1 - H

6.2.6 Two OPGDs perpendicular to each other inside each grade.

Risk Grades

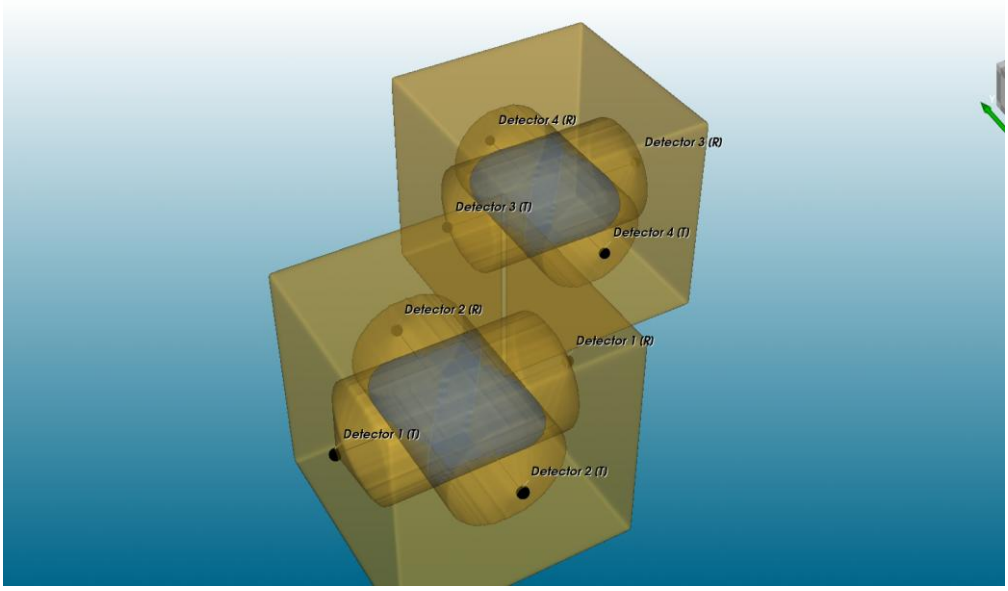
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

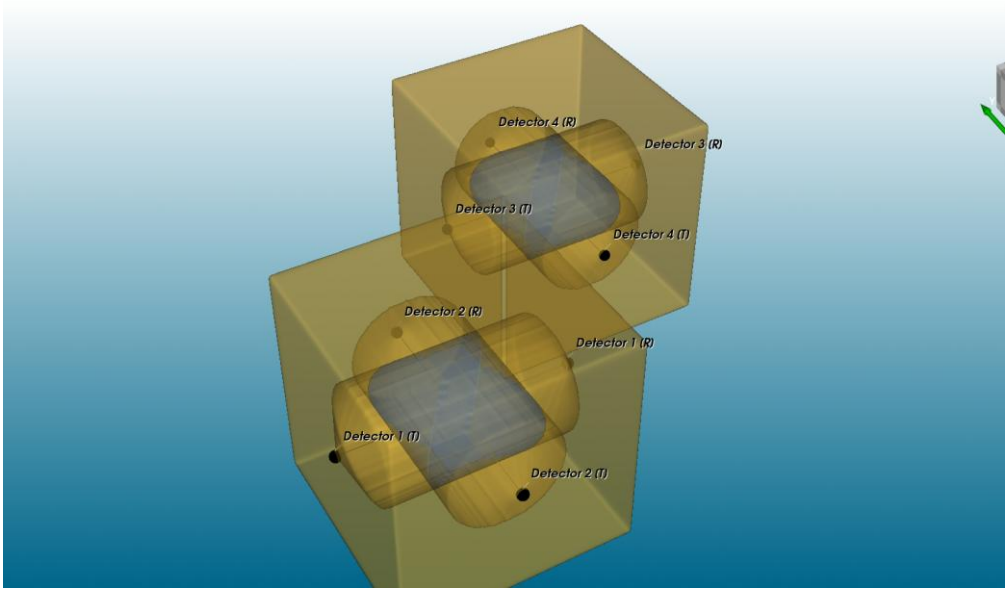
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 10 m

Coverage Results

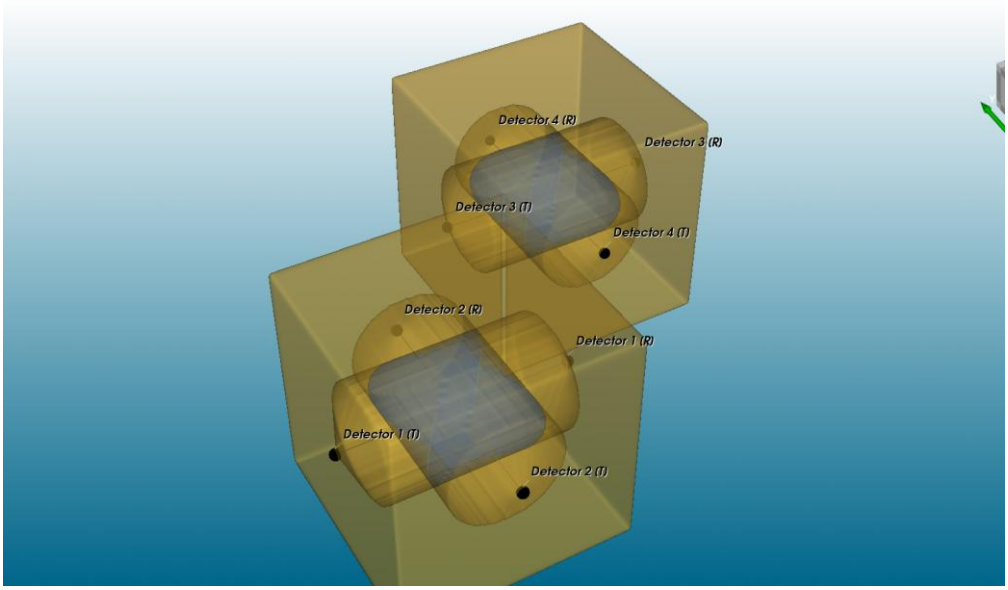
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	2ooN	LL	8.33	8.29	0.04
Grade D	2ooN	LH	8.33	8.29	0.04
Grade D	2ooN	HH	8.33	8.29	0.04



View 1 - LL



View 1 - LH


Detector 4 (R)
Detector 3 (R)
Detector 3 (T)
Detector 4 (T)
Detector 2 (R)
Detector 1 (R)
Detector 1 (T)
Detector 2 (T)

View 1 - HH

6.2.7 Two OPGDs parallel to each other inside each grade.

Risk Grades

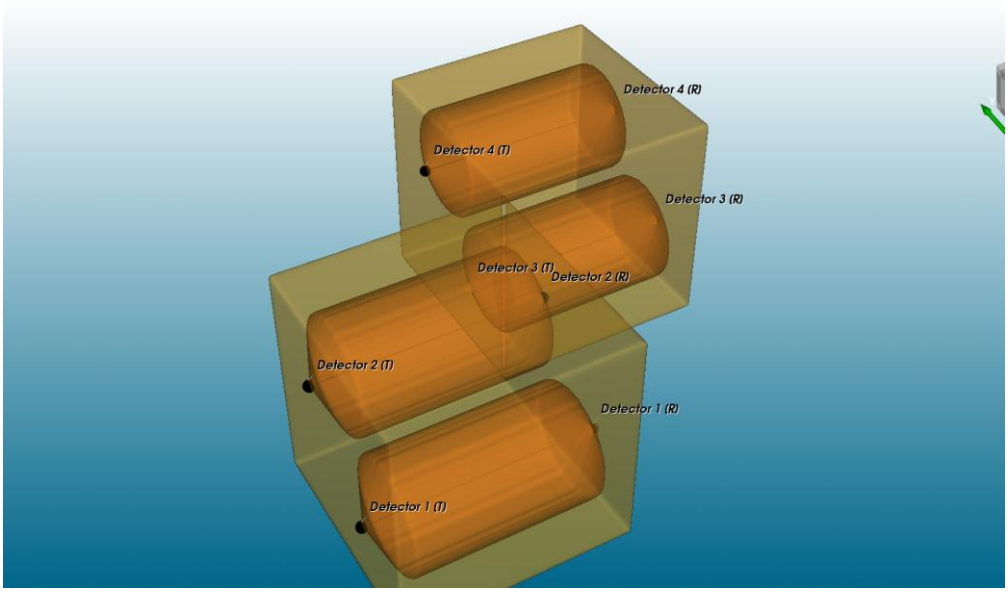
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

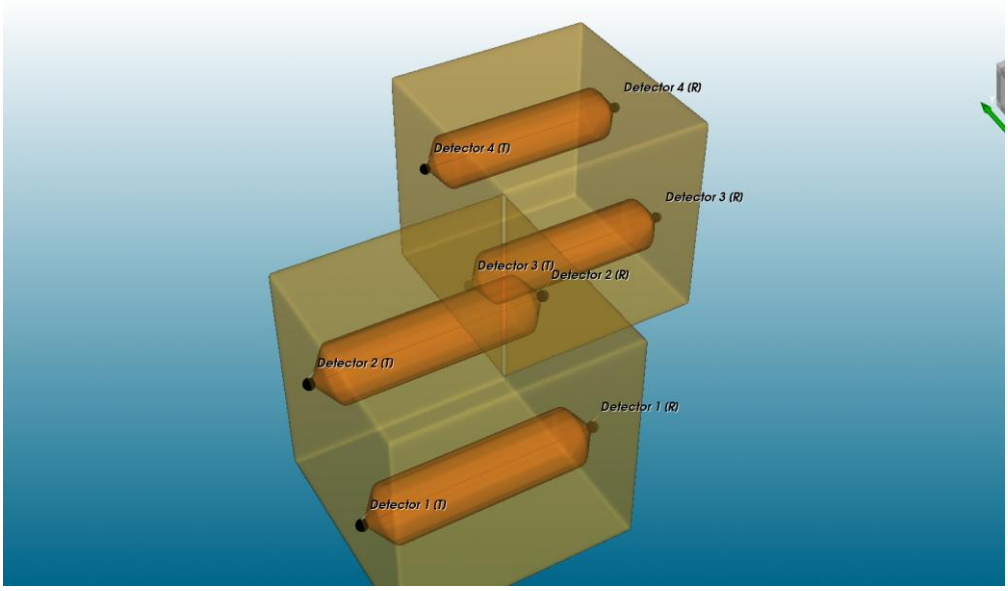
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade C - Low 10 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	34.03	34.08	0.05
Grade C	1ooN	H	8.51	8.55	0.04



View 1 - L



View 1 - H

6.2.8 One OPGD inside each grade with half of detector's FOI outside the grade.

Risk Grades

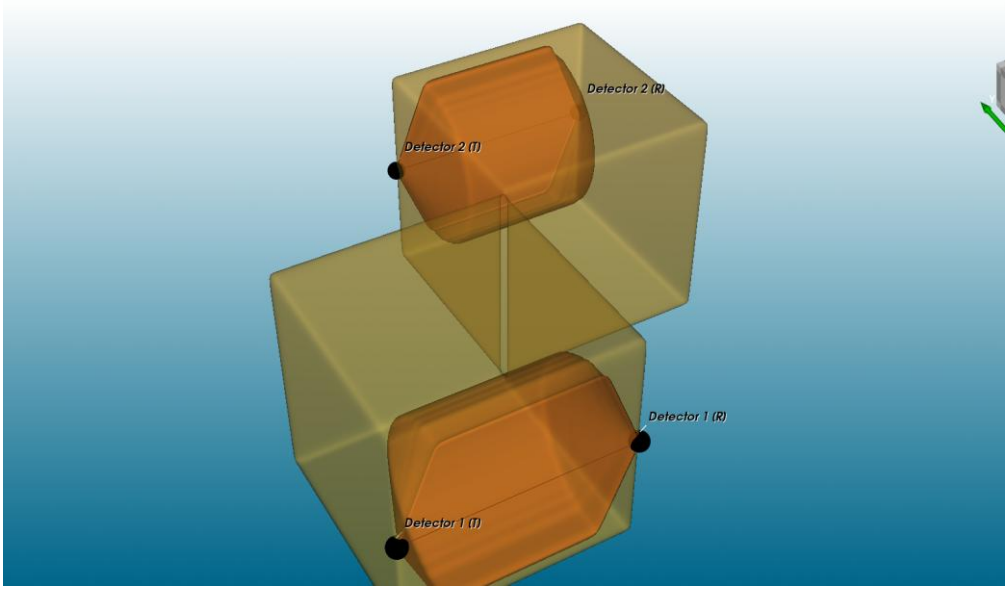
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D

Gas Detectors

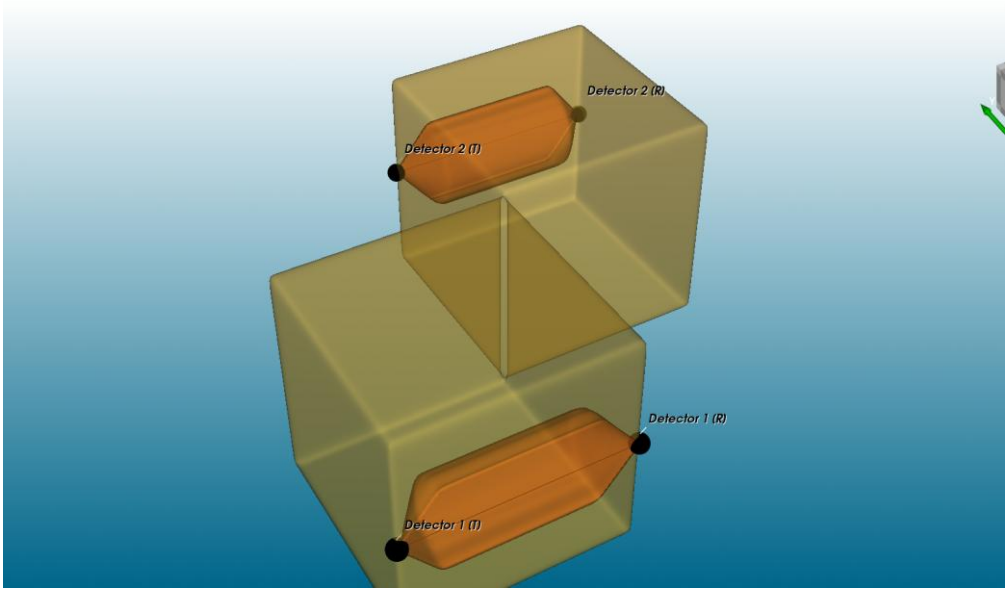
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	12 m	Grade D - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2	12 m	Grade D - Low 10 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	21.21	21.09	0.12
Grade D	1ooN	H	5.31	5.24	0.07



View 1 - L



View 1 - H

6.2.9 One OPGD and one PGD with non-intersecting FOIs inside each grade.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

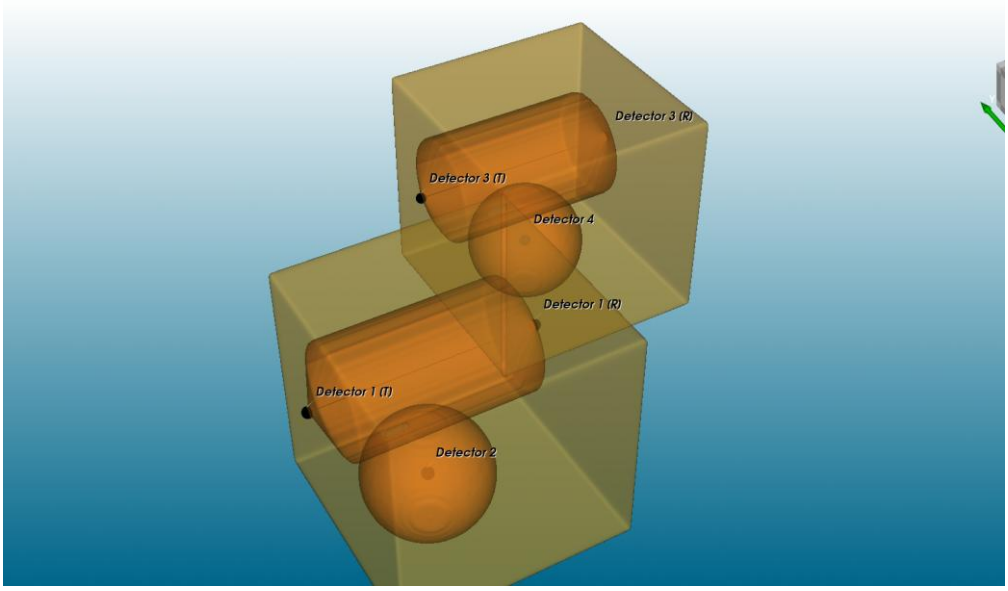
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2	-	Grade D - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2	-	Grade D - Low 10 m / High 5 m

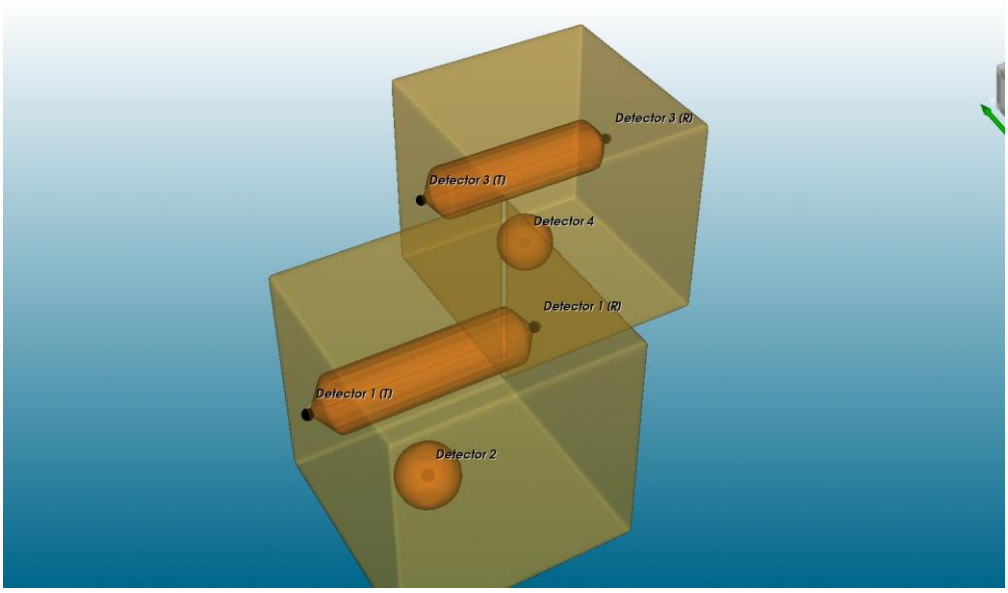
Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	23.56	23.46	0.10
Grade D	1ooN	H	5.07	5.02	0.05

Note: Best-effort placement — see lib/geometry.mjs module note.



View 1 - L



View 1 - H

6.2.10 One OPGD and one PGD with overlapping FOIs inside each grade. 2ooN coverage assessed.

Risk Grades

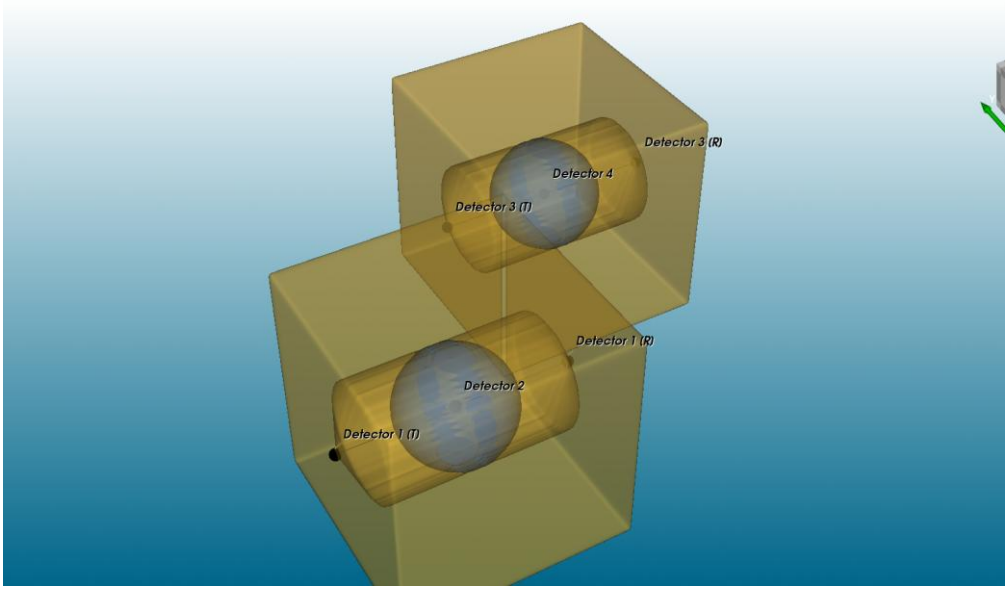
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

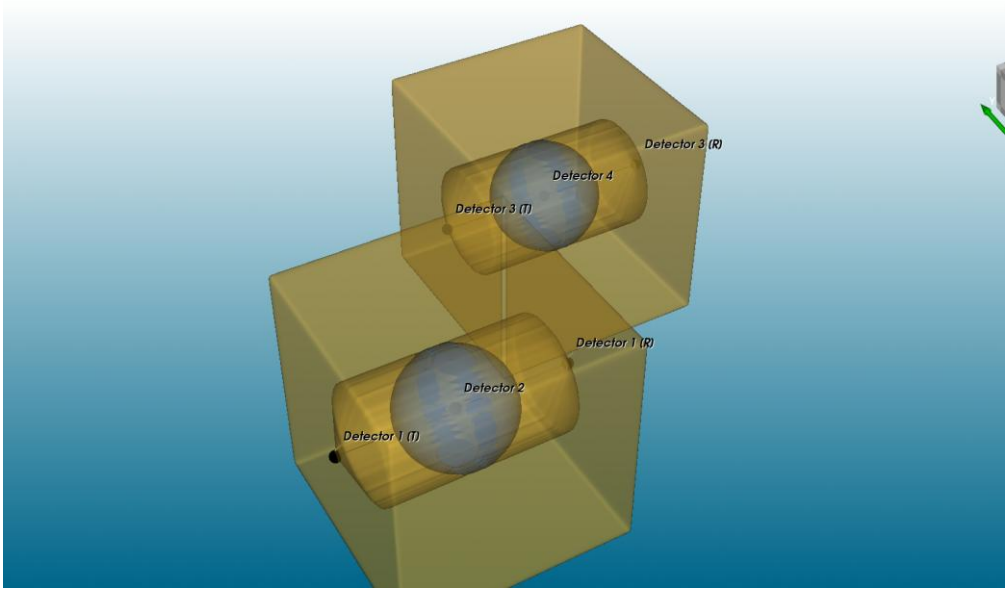
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 10 m
Point Gas Detector (PGD)	H2	-	Grade D - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2	20 m	Grade D - Low 10 m / High 10 m
Point Gas Detector (PGD)	H2	-	Grade D - Low 10 m / High 10 m

Coverage Results

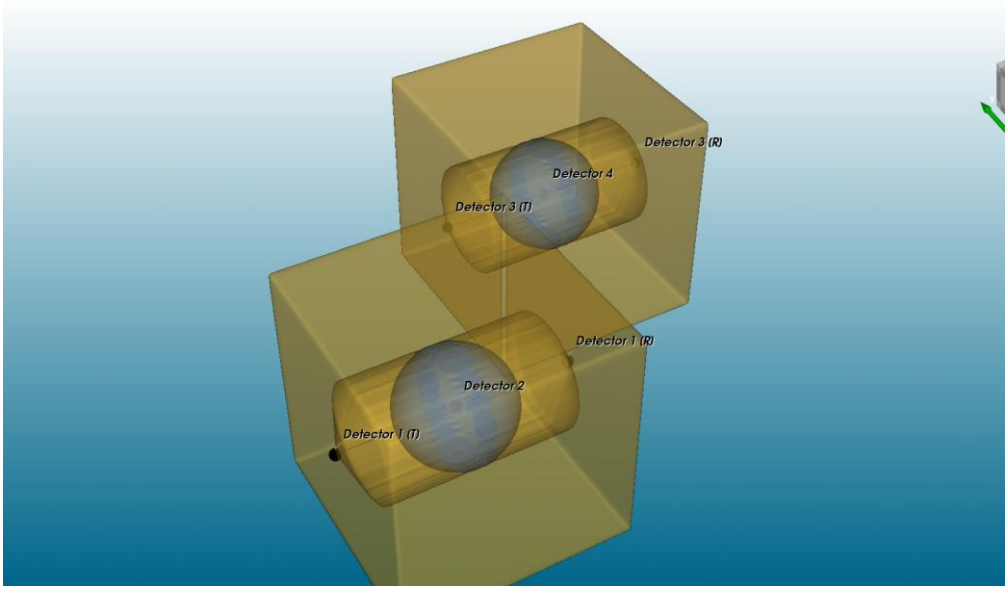
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	2ooN	LL	6.54	6.53	0.01
Grade D	2ooN	LH	6.54	6.53	0.01
Grade D	2ooN	HH	6.54	6.53	0.01



View 1 - LL



View 1 - LH


Detector 3 (R)
Detector 4
Detector 3 (T)
Detector 1 (R)
Detector 2
Detector 1 (T)

View 1 - HH

6.2.11 Two OPGDs parallel to each other and overlapping FOI inside each grade. 2ooN coverage assessed.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

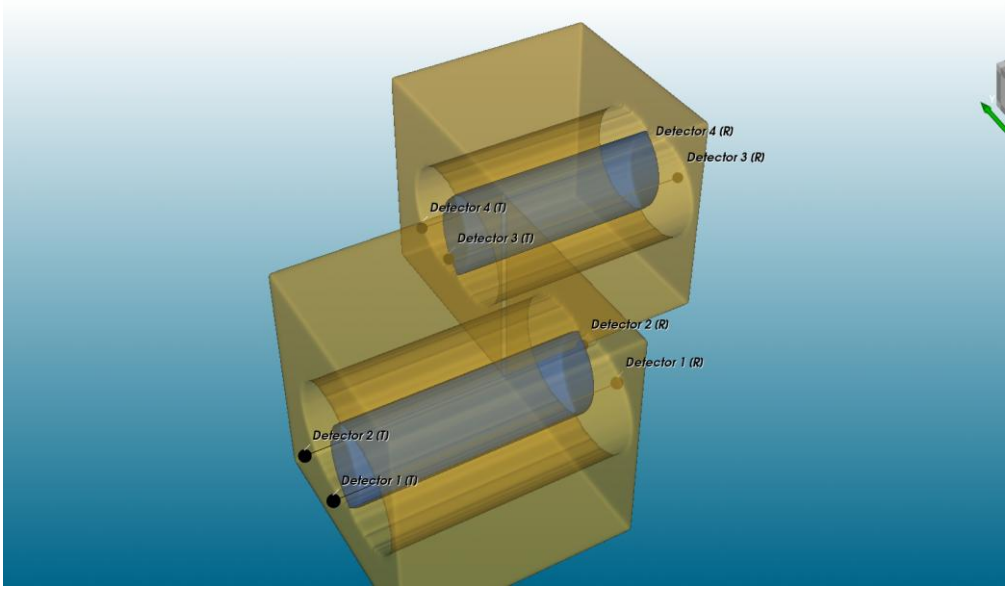
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2	24 m	Grade B - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2	24 m	Grade B - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2	24 m	Grade B - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2	24 m	Grade B - Low 10 m / High 10 m

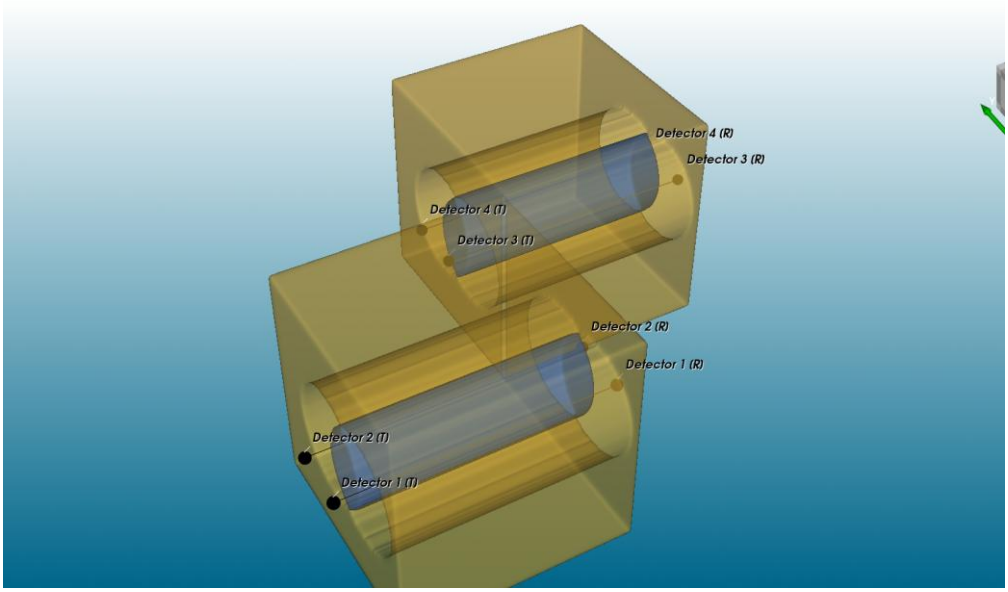
Analytical Formula: $(1.228 \times R^2 \times (\text{Range}-4)) / 80$

Coverage Results

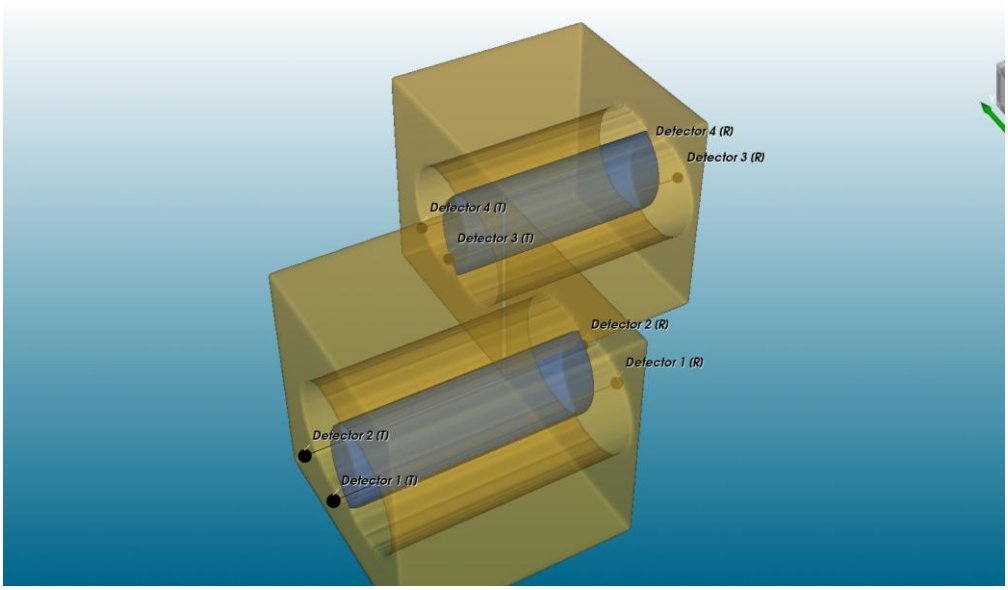
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	LL	7.67	7.66	0.01
Grade B	2ooN	LH	7.67	7.66	0.01
Grade B	2ooN	HH	7.67	7.66	0.01



View 1 - LL



View 1 - LH


Detector 4 (R)
Detector 3 (R)
Detector 4 (T)
Detector 3 (T)
Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

View 1 - HH

6.2.12 Two grades overlapping each other. One PGD with its FOI completely inside both the grades simultaneously.

Risk Grades

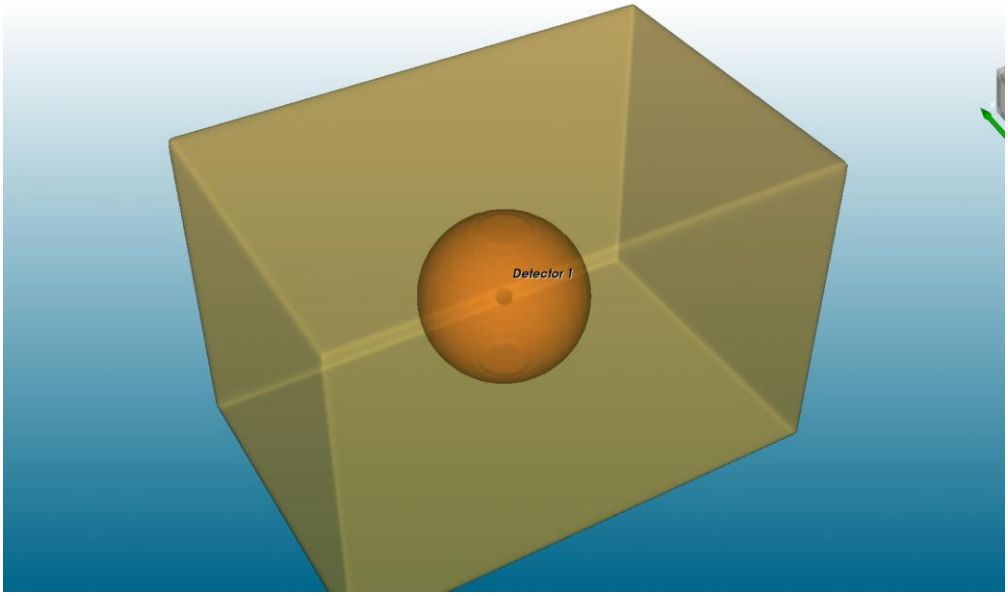
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

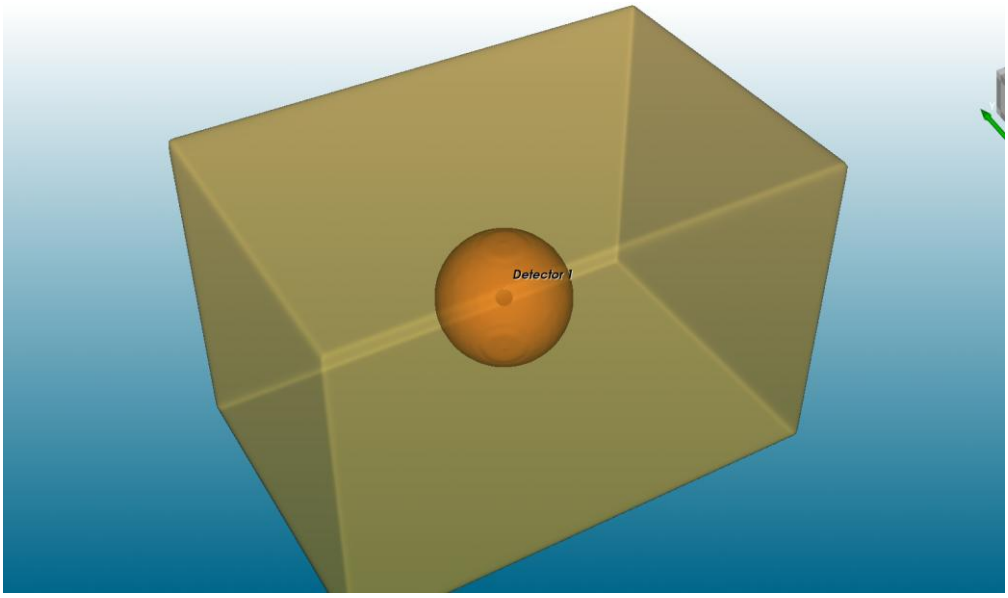
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade D - Low 10 m / High 8 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	4.36	4.33	0.03
Grade D	1ooN	H	2.23	2.22	0.01



View 1 - L



View 1 - H

6.2.13 One PGD inside each cylindrical grade with its FOI completely inside the relelvant grade.

Risk Grades

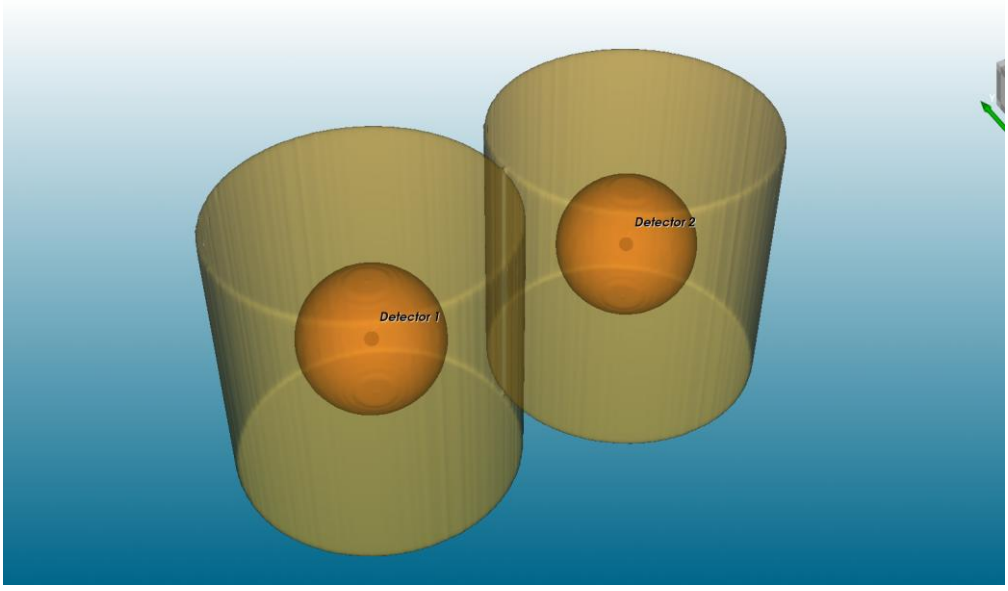
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade B
Cylinder	Radius 10 m, Height 20 m	Grade B

Gas Detectors

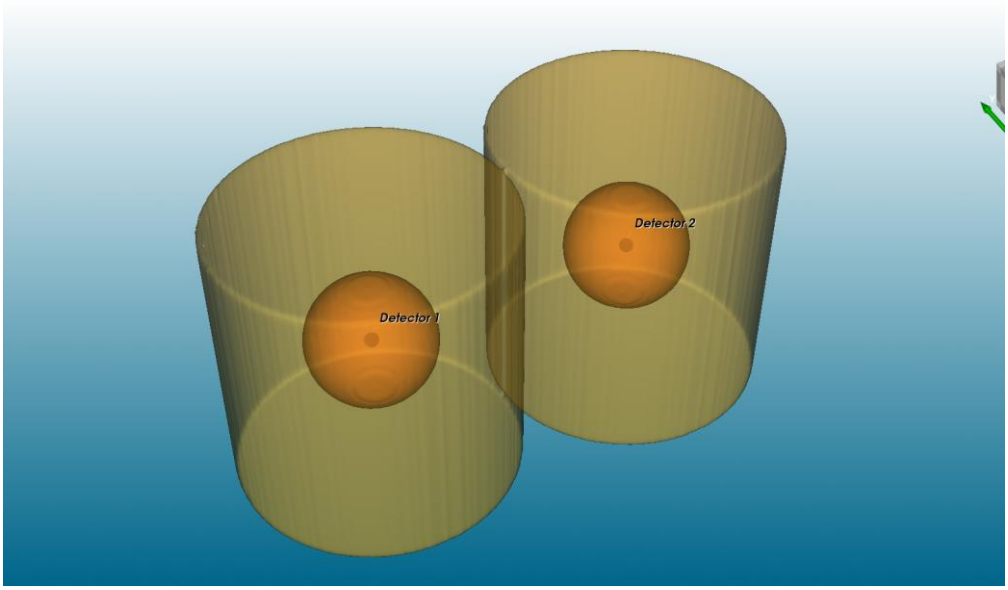
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2	Grade B - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2	Grade B - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	8.33	8.33	0.00
Grade B	1ooN	H	6.08	6.08	0.00



View 1 - L



View 1 - H

6.3 Two Grades of Different Types

6.3.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside each grade

Risk Grades

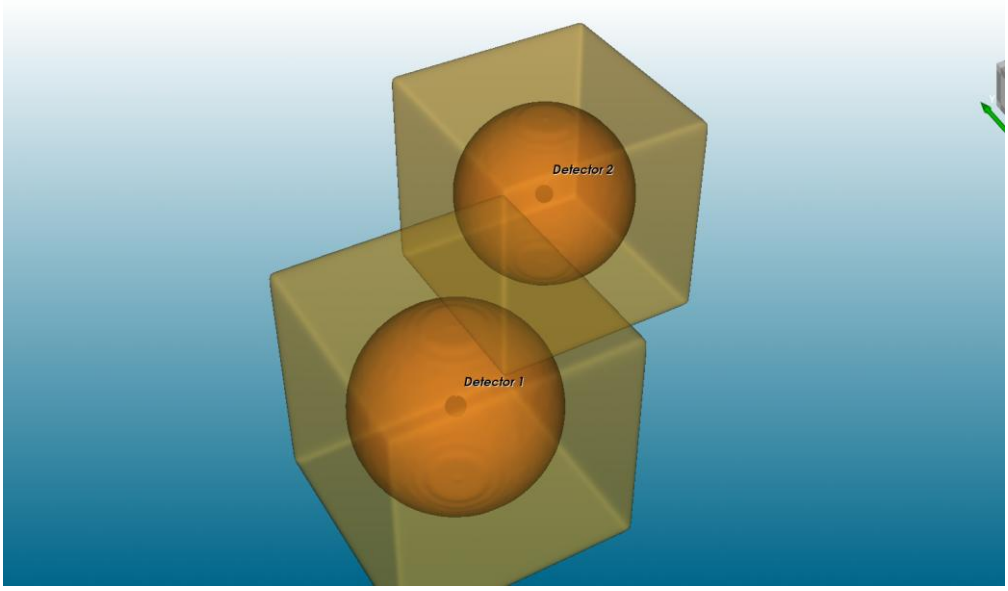
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

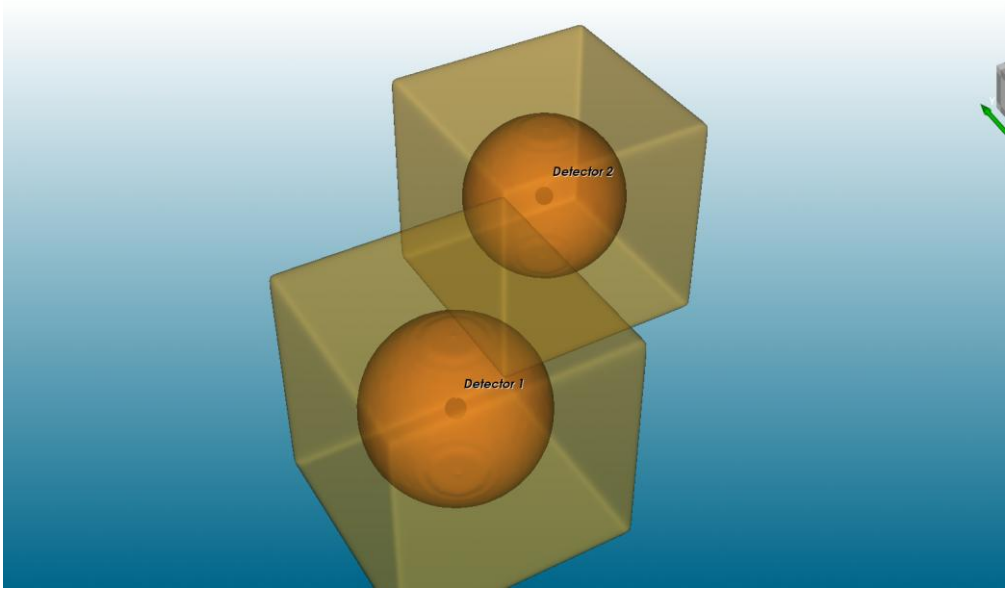
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade D - Low 10 m / High 9 m Grade B - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2S	Grade D - Low 10 m / High 9 m Grade B - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	30.3	30.24	0.06
Grade B	1ooN	L	30.3	30.24	0.06
Grade D	1ooN	H	22.09	22.08	0.01
Grade B	1ooN	H	22.09	22.08	0.01



View 1 - L



View 1 - H

6.3.2 Two PGDs with non-interacting (FOI) completely inside each grade.

Risk Grades

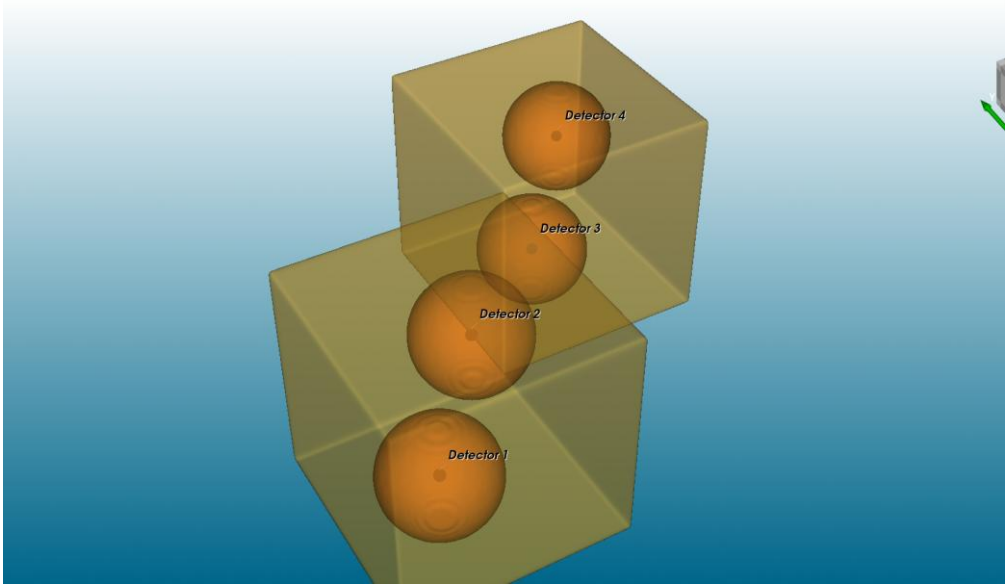
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

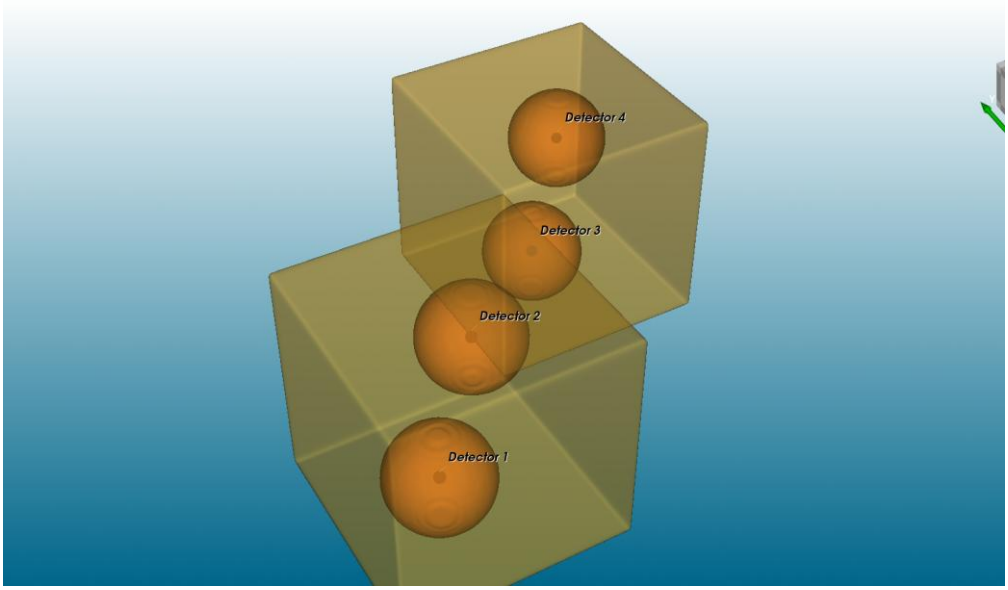
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade C - Low 10 m / High 9 m Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2S	Grade C - Low 10 m / High 9 m Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2S	Grade C - Low 10 m / High 9 m Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2S	Grade C - Low 10 m / High 9 m Grade A - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	13.11	13.09	0.02
Grade A	1ooN	L	13.11	13.09	0.02
Grade C	1ooN	H	9.54	9.54	0.00
Grade A	1ooN	H	9.54	9.54	0.00



View 1 - L



View 1 - H

6.3.3 Two PGDs inside each grade with one detector located at the edge of the FOI of the other detector. 2 Cubical Grades used. 2ooN coverage assessed.

Risk Grades

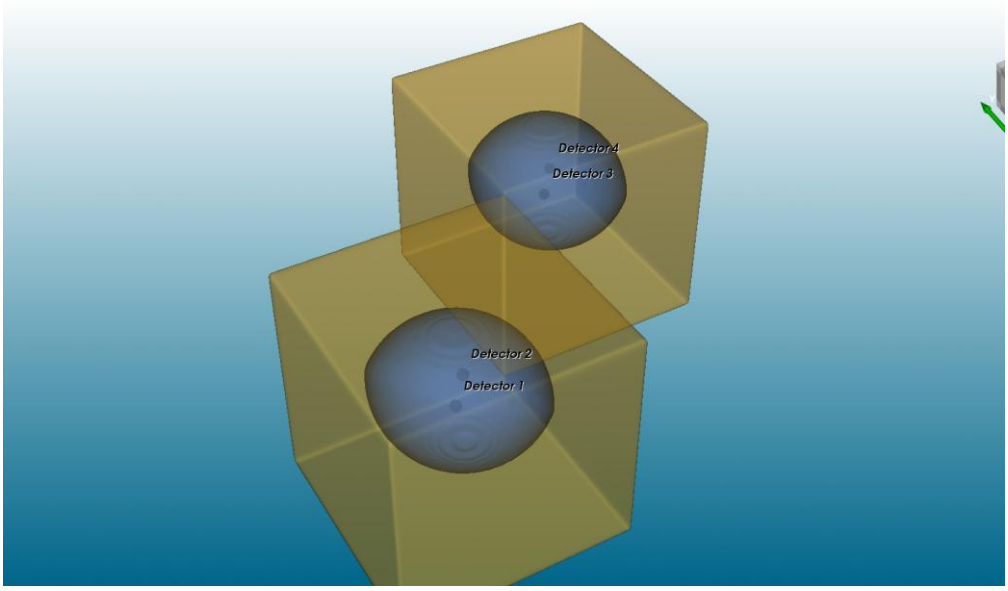
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

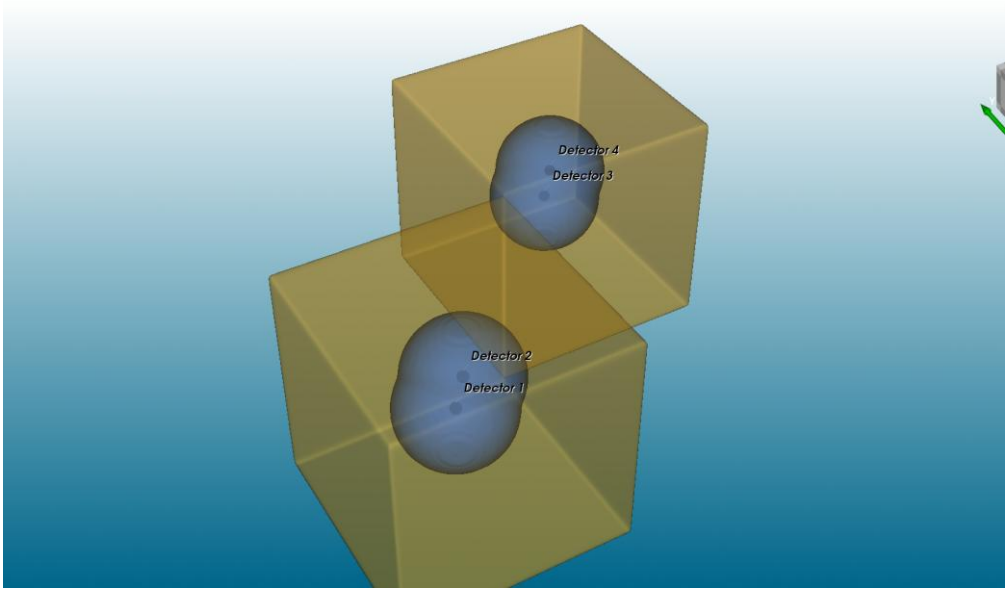
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade C - Low 15 m / High 10 m Grade A - Low 15 m / High 10 m
Point Gas Detector (PGD)	H2S	Grade C - Low 15 m / High 10 m Grade A - Low 15 m / High 10 m
Point Gas Detector (PGD)	H2S	Grade C - Low 15 m / High 10 m Grade A - Low 15 m / High 10 m
Point Gas Detector (PGD)	H2S	Grade C - Low 15 m / High 10 m Grade A - Low 15 m / High 10 m

Coverage Results

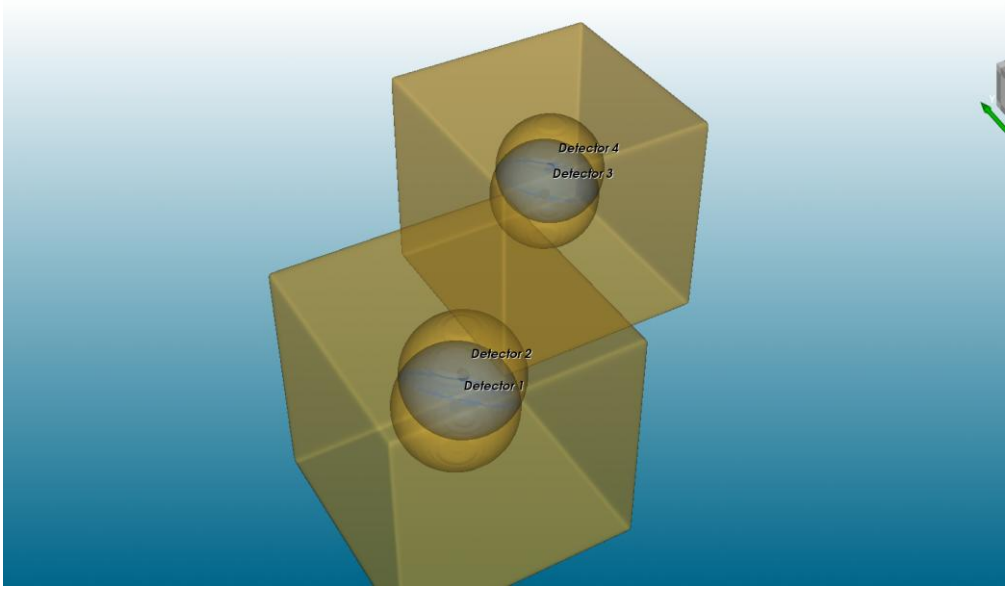
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	LL	16.62	16.61	0.01
Grade A	2ooN	LL	16.62	16.61	0.01
Grade C	2ooN	LH	8.95	8.94	0.01
Grade A	2ooN	LH	8.95	8.94	0.01
Grade C	2ooN	HH	4.14	4.14	0.00
Grade A	2ooN	HH	4.14	4.14	0.00



View 1 - LL



View 1 - LH



View 1 - HH

6.3.4 One PGD located at the edge of each cubical grade. Exactly half portion of detector's FOI is outside the respective grade.

Risk Grades

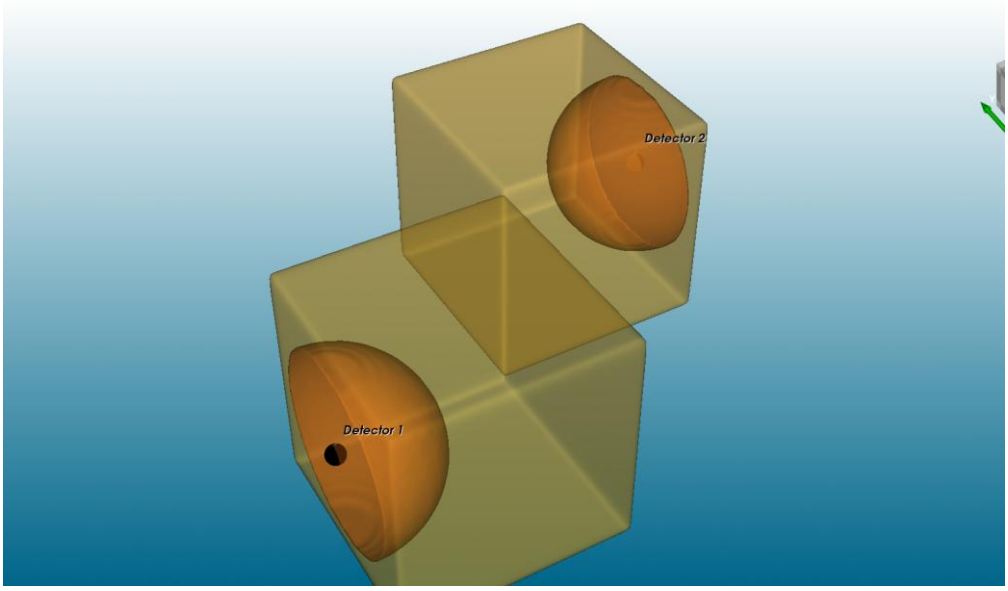
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A

Gas Detectors

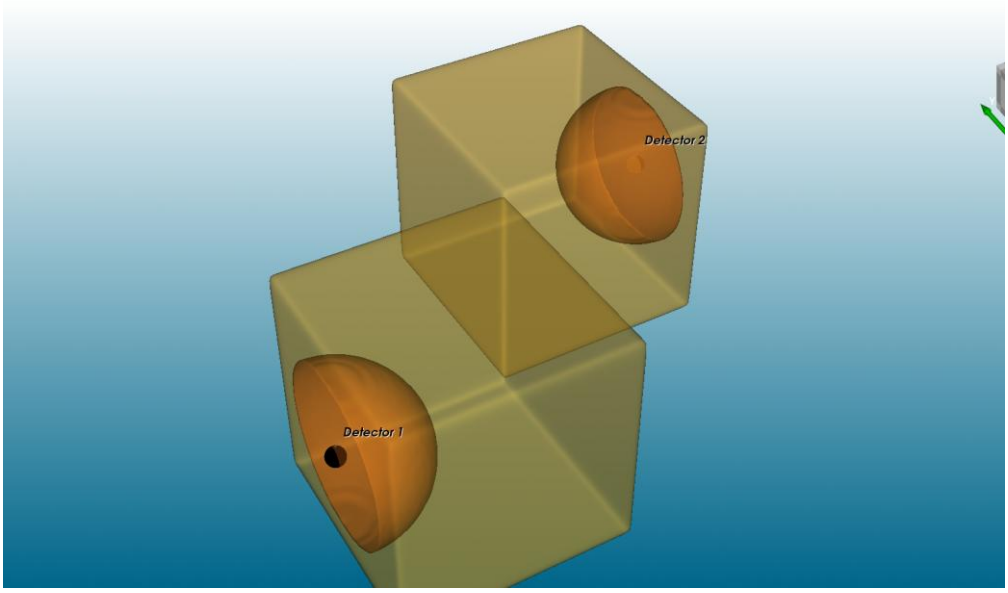
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade D - Low 10 m / High 9 m Grade A - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2S	Grade D - Low 10 m / High 9 m Grade A - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	15.15	15.12	0.03
Grade A	1ooN	L	15.15	15.12	0.03
Grade D	1ooN	H	11.04	11.04	0.00
Grade A	1ooN	H	11.04	11.04	0.00



View 1 - L



View 1 - H

6.3.5 One Open Path Gas Detector (OPGD) with its FOI completely inside each grade.

Risk Grades

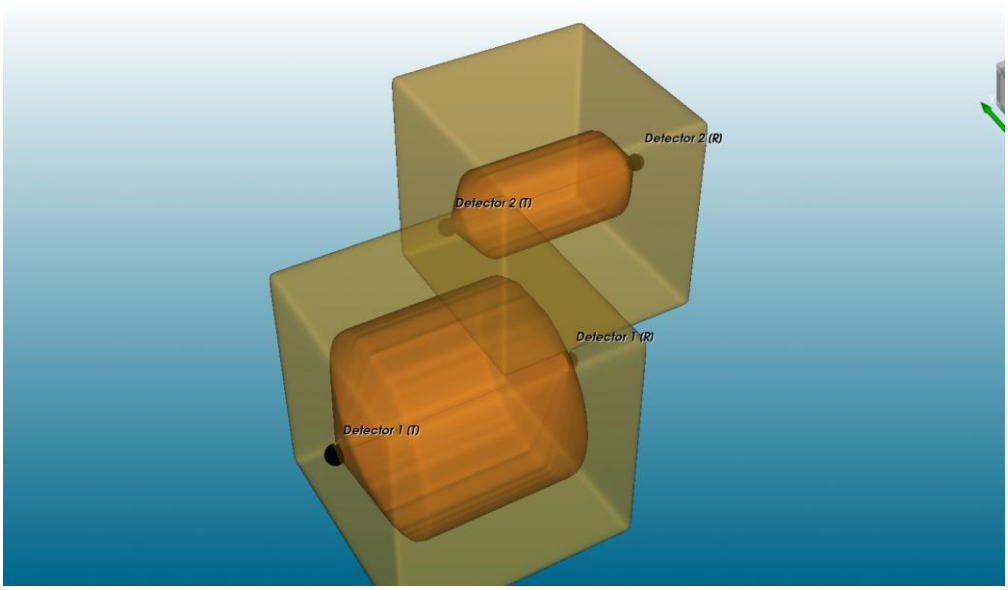
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade D
Cube	Length 12 m, Width 12 m, Height 12 m	Grade A

Gas Detectors

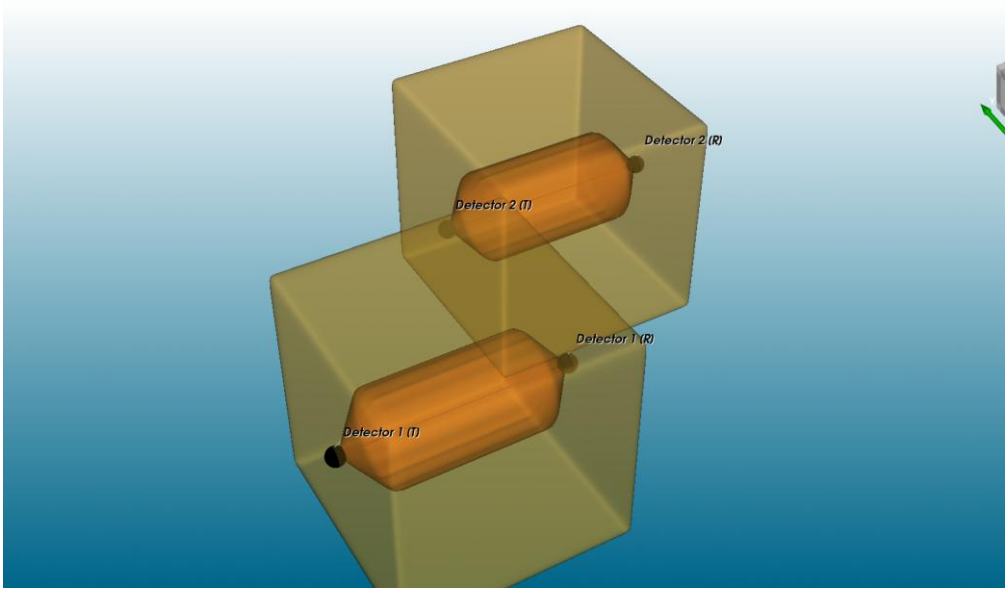
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	12 m	Grade D - Low 10 m / High 5 m Grade A - Low 5 m / High 5 m
Open Path Gas Detector (OPGD)	H2S	12 m	Grade D - Low 10 m / High 5 m Grade A - Low 5 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	42.42	42.18	0.24
Grade A	1ooN	L	10.61	10.48	0.13
Grade D	1ooN	H	10.61	10.48	0.13
Grade A	1ooN	H	10.61	10.48	0.13



View 1 - L



View 1 - H

6.3.6 Two OPGDs perpendicular to each other inside each grade.

Risk Grades

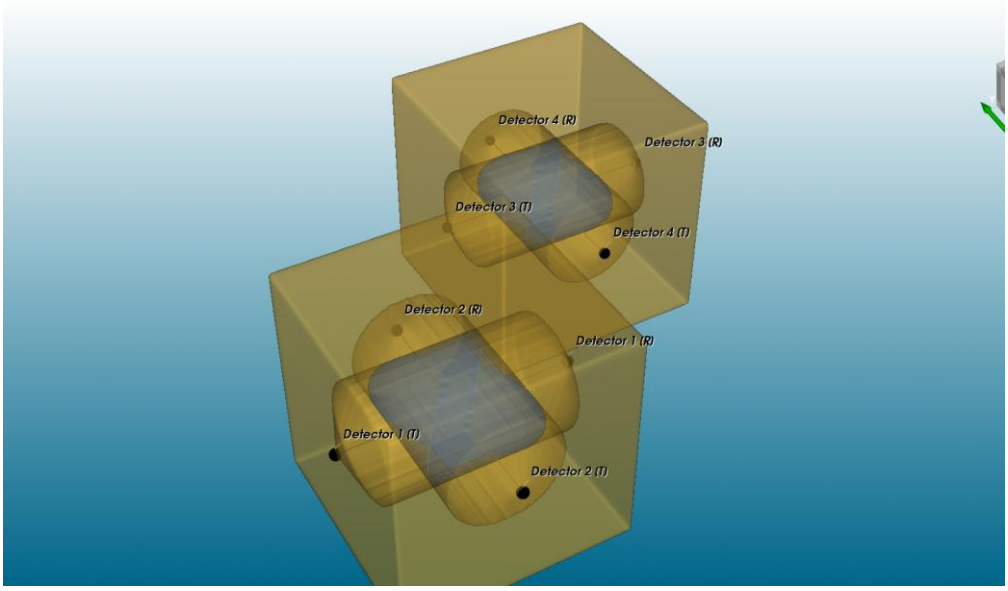
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

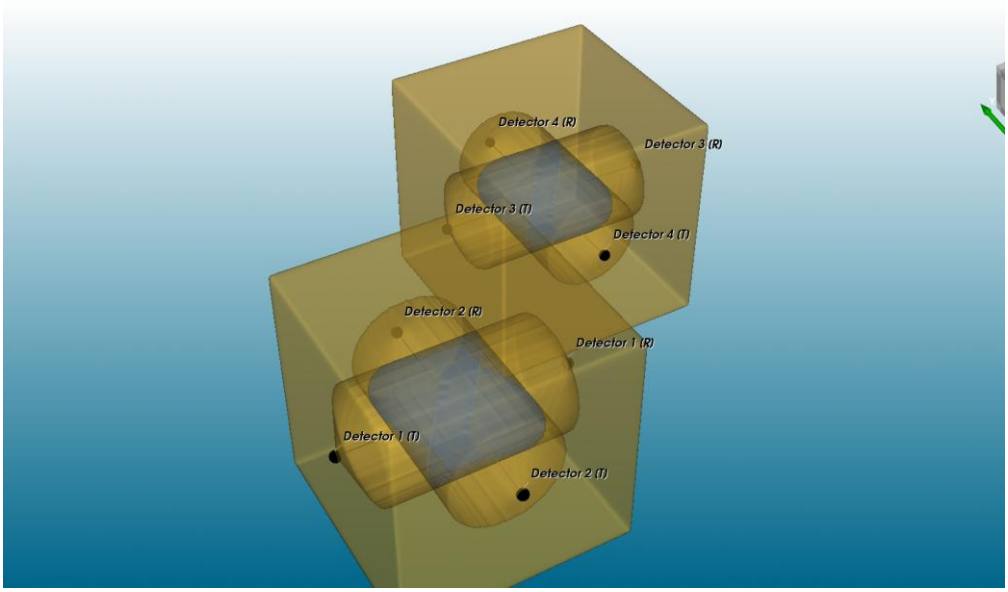
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - Low 10 m / High 10 m Grade D - Low 9 m / High 9 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - Low 10 m / High 10 m Grade D - Low 9 m / High 9 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - Low 10 m / High 10 m Grade D - Low 9 m / High 9 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - Low 10 m / High 10 m Grade D - Low 9 m / High 9 m

Coverage Results

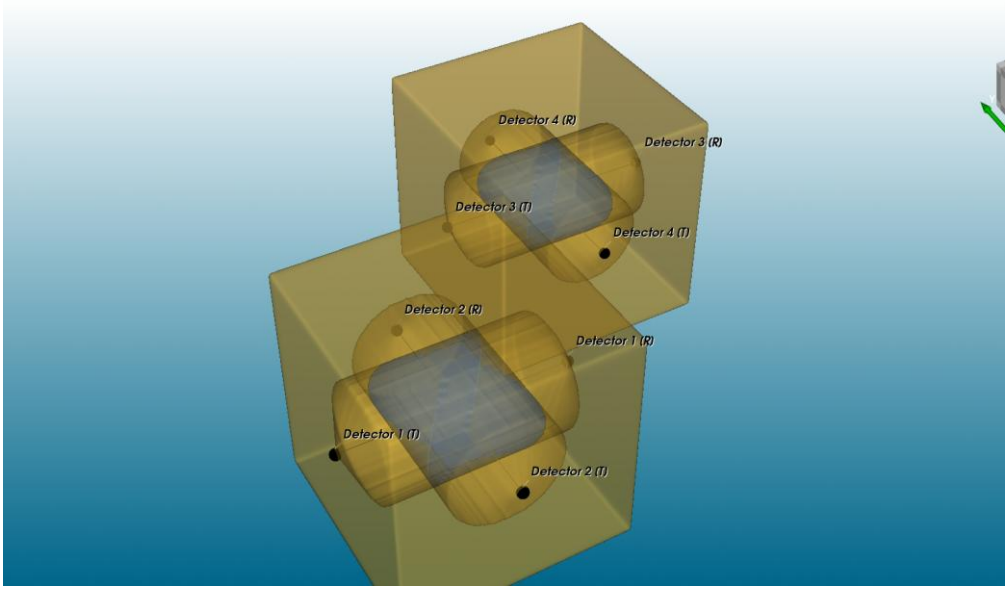
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	LL	8.33	8.29	0.04
Grade D	2ooN	LL	6.08	6.06	0.02
Grade B	2ooN	LH	8.33	8.29	0.04
Grade D	2ooN	LH	6.08	6.06	0.02
Grade B	2ooN	HH	8.33	8.29	0.04
Grade D	2ooN	HH	6.08	6.06	0.02



View 1 - LL



View 1 - LH


Detector 4 (R)
Detector 3 (R)
Detector 3 (T)
Detector 4 (T)
Detector 2 (R)
Detector 1 (R)
Detector 1 (T)
Detector 2 (T)

View 1 - HH

6.3.7 Two OPGDs parallel to each other inside each grade.

Risk Grades

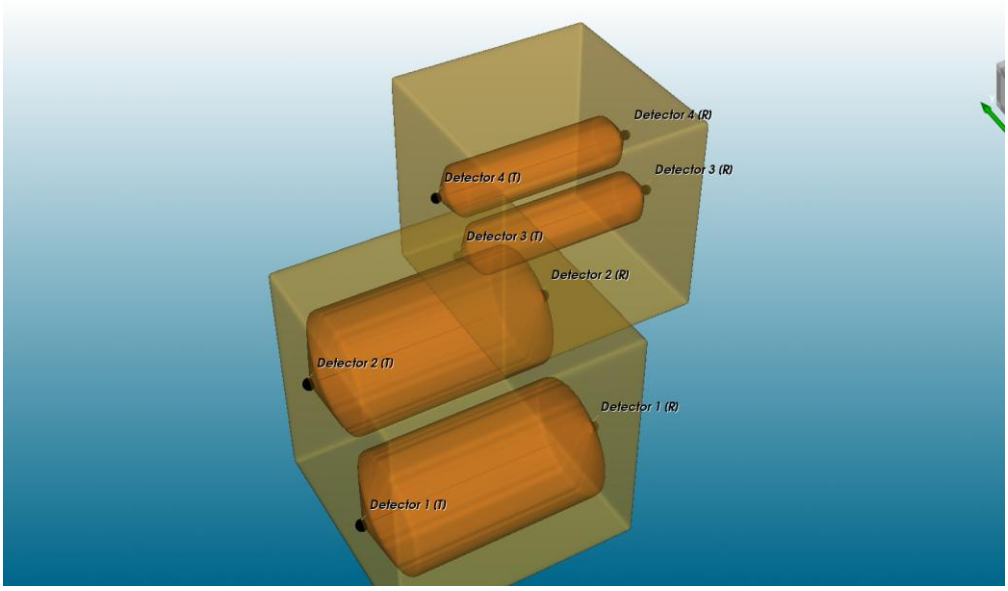
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

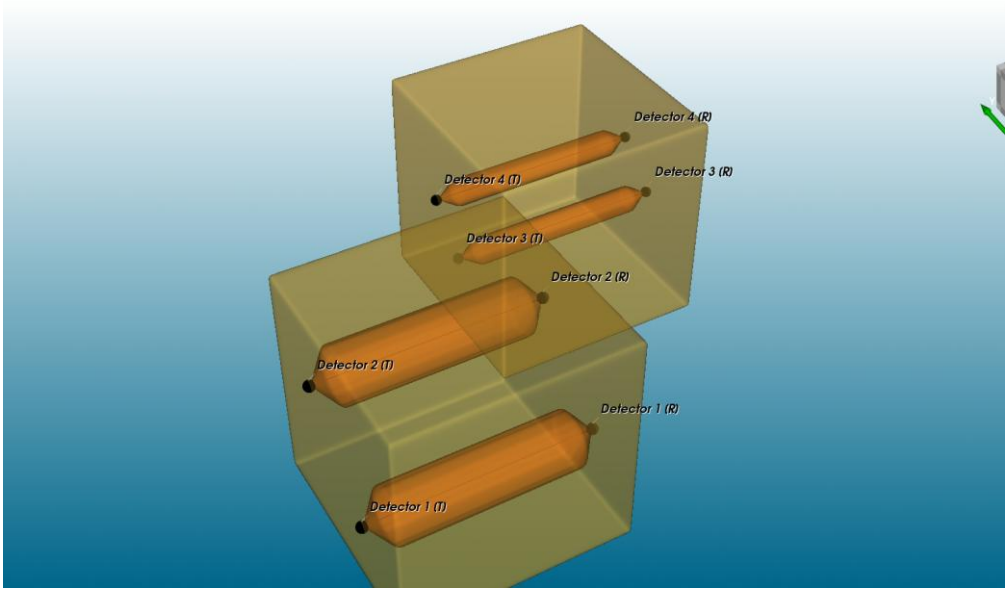
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade D - Low 10 m / High 5 m Grade B - Low 5 m / High 2.5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade D - Low 10 m / High 5 m Grade B - Low 5 m / High 2.5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade D - Low 10 m / High 5 m Grade B - Low 5 m / High 2.5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade D - Low 10 m / High 5 m Grade B - Low 5 m / High 2.5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	34.03	34.08	0.05
Grade B	1ooN	L	8.51	8.52	0.01
Grade D	1ooN	H	8.51	8.55	0.04
Grade B	1ooN	H	2.13	2.13	0.00



View 1 - L



View 1 - H

6.3.8 One OPGD inside each grade with half of detector's FOI outside the grade.

Risk Grades

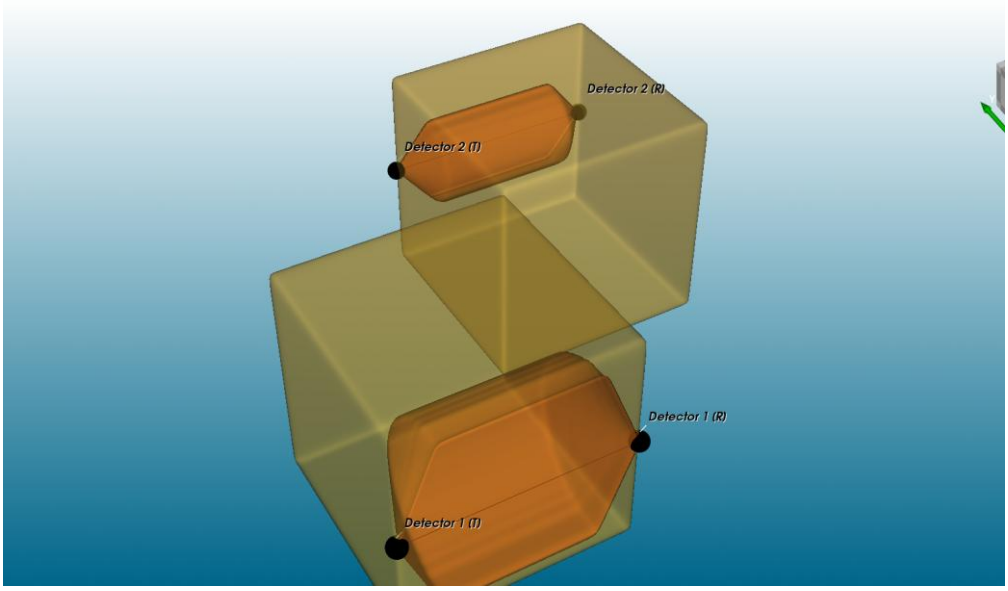
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 12 m, Width 12 m, Height 12 m	Grade C
Cube	Length 12 m, Width 12 m, Height 12 m	Grade B

Gas Detectors

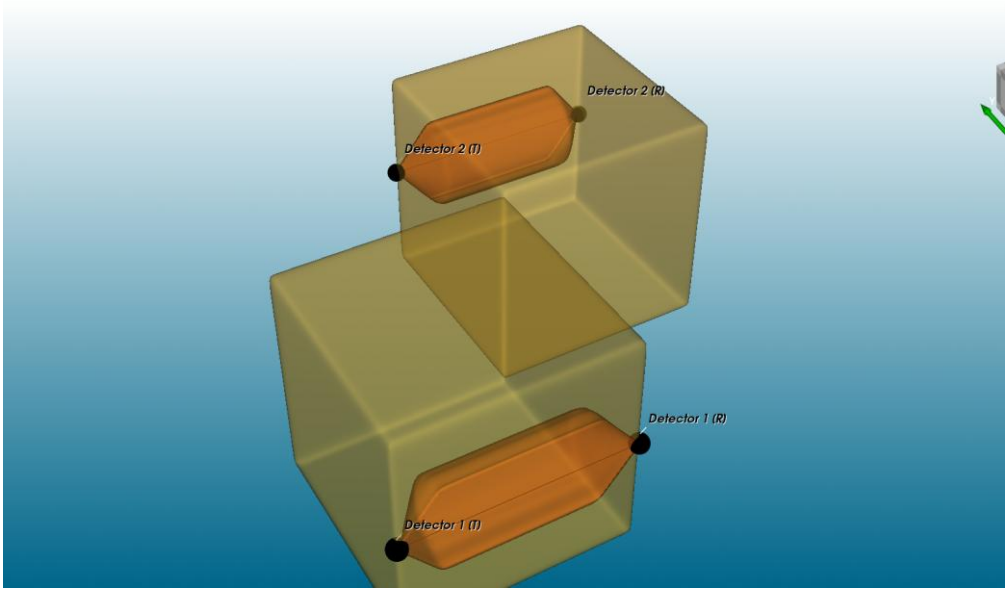
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	12 m	Grade C - Low 10 m / High 5 m Grade B - Low 5 m / High 5 m
Open Path Gas Detector (OPGD)	H2S	12 m	Grade C - Low 10 m / High 5 m Grade B - Low 5 m / High 5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	21.21	21.09	0.12
Grade B	1ooN	L	5.31	5.24	0.07
Grade C	1ooN	H	5.31	5.24	0.07
Grade B	1ooN	H	5.31	5.24	0.07



View 1 - L



View 1 - H

6.3.9 One OPGD and one PGD with non-intersecting FOIs inside each grade.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

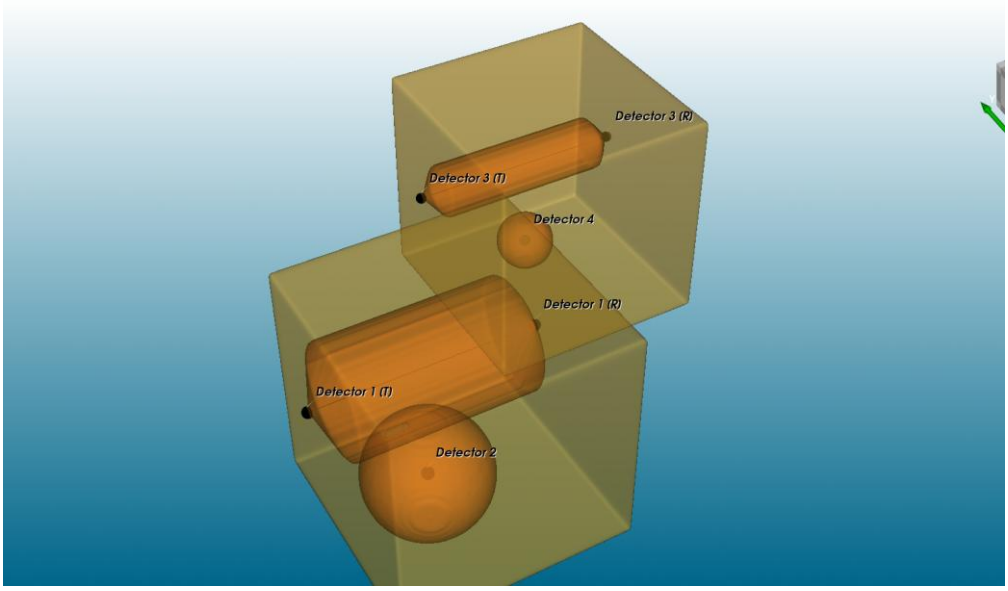
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade C - Low 10 m / High 5 m Grade A - Low 5 m / High 5 m
Point Gas Detector (PGD)	H2S	-	Grade C - Low 10 m / High 5 m Grade A - Low 5 m / High 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade C - Low 10 m / High 5 m Grade A - Low 5 m / High 5 m
Point Gas Detector (PGD)	H2S	-	Grade C - Low 10 m / High 5 m Grade A - Low 5 m / High 5 m

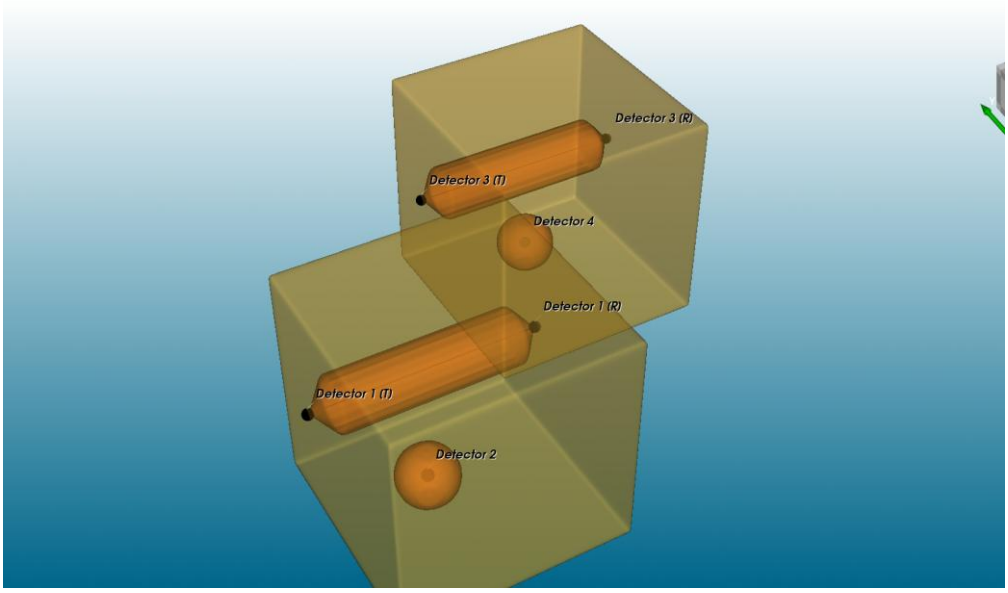
Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	23.56	23.46	0.10
Grade A	1ooN	L	5.07	5.02	0.05
Grade C	1ooN	H	5.07	5.02	0.05
Grade A	1ooN	H	5.07	5.02	0.05

Note: Best-effort placement — see lib/geometry.mjs module note.



View 1 - L



View 1 - H

6.3.10 One OPGD and one PGD with overlapping FOIs inside each grade. 2ooN coverage assessed.

Risk Grades

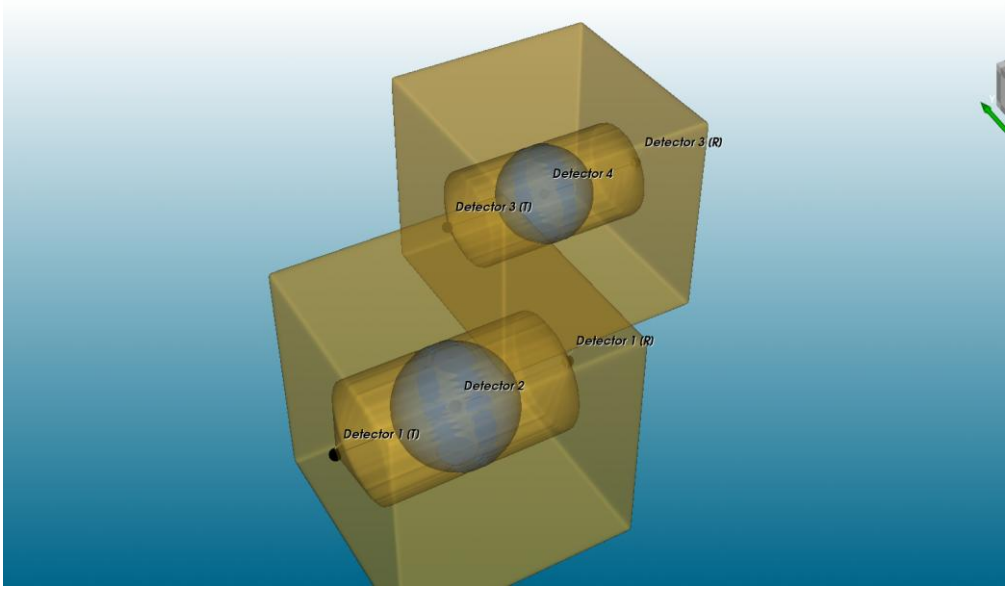
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

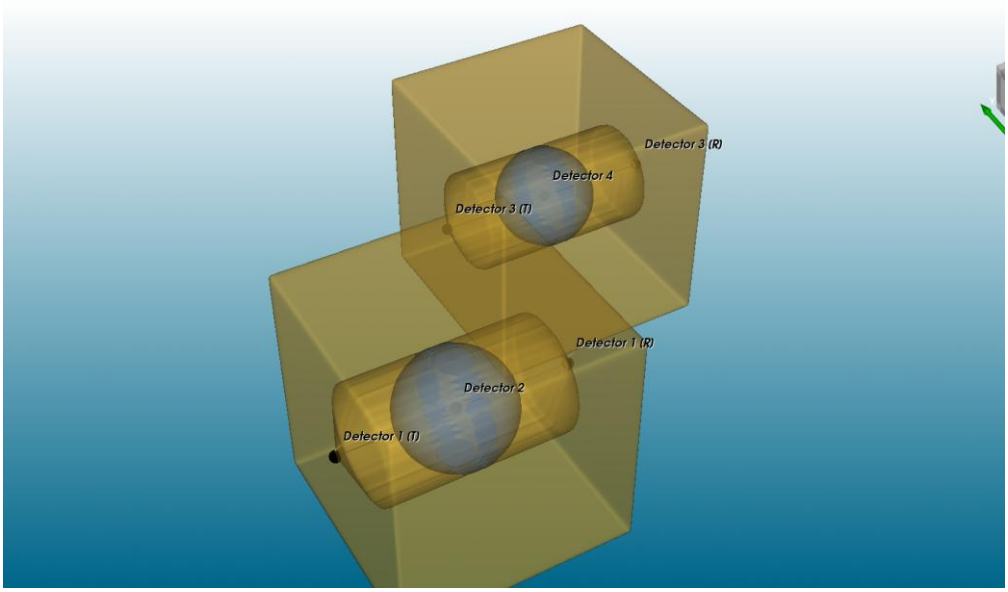
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	20 m	Grade D - Low 10 m / High 10 m Grade A - Low 9 m / High 9 m
Point Gas Detector (PGD)	H2S	-	Grade D - Low 10 m / High 10 m Grade A - Low 9 m / High 9 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade D - Low 10 m / High 10 m Grade A - Low 9 m / High 9 m
Point Gas Detector (PGD)	H2S	-	Grade D - Low 10 m / High 10 m Grade A - Low 9 m / High 9 m

Coverage Results

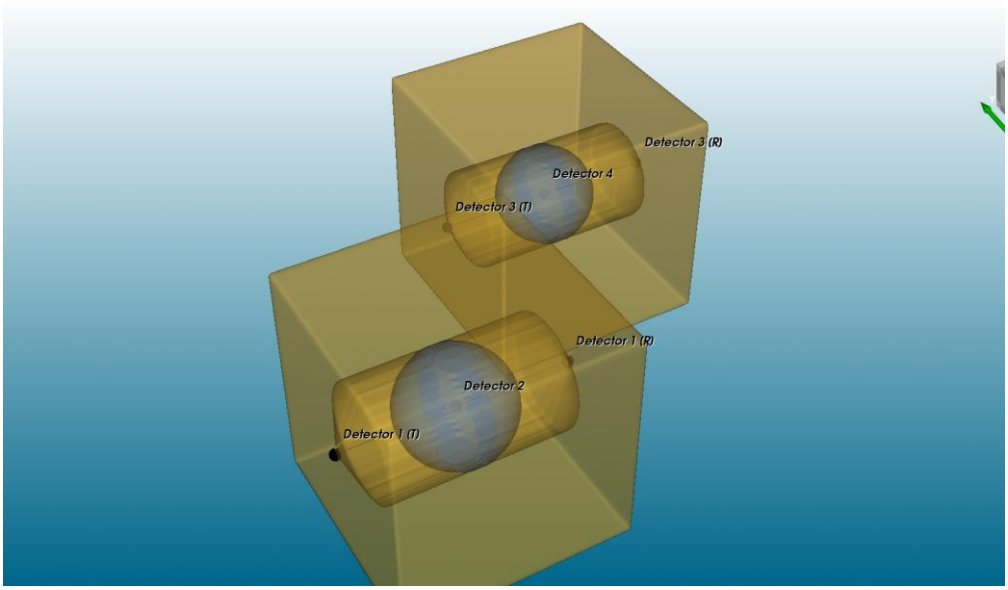
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	2ooN	LL	6.54	6.53	0.01
Grade A	2ooN	LL	4.77	4.77	0.00
Grade D	2ooN	LH	6.54	6.53	0.01
Grade A	2ooN	LH	4.77	4.77	0.00
Grade D	2ooN	HH	6.54	6.53	0.01
Grade A	2ooN	HH	4.77	4.77	0.00



View 1 - LL



View 1 - LH


Detector 3 (R)
Detector 4
Detector 3 (T)
Detector 1 (R)
Detector 2
Detector 1 (T)

View 1 - HH

6.3.11 Two OPGDs parallel to each other and overlapping FOI inside each grade. 2ooN coverage assessed.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

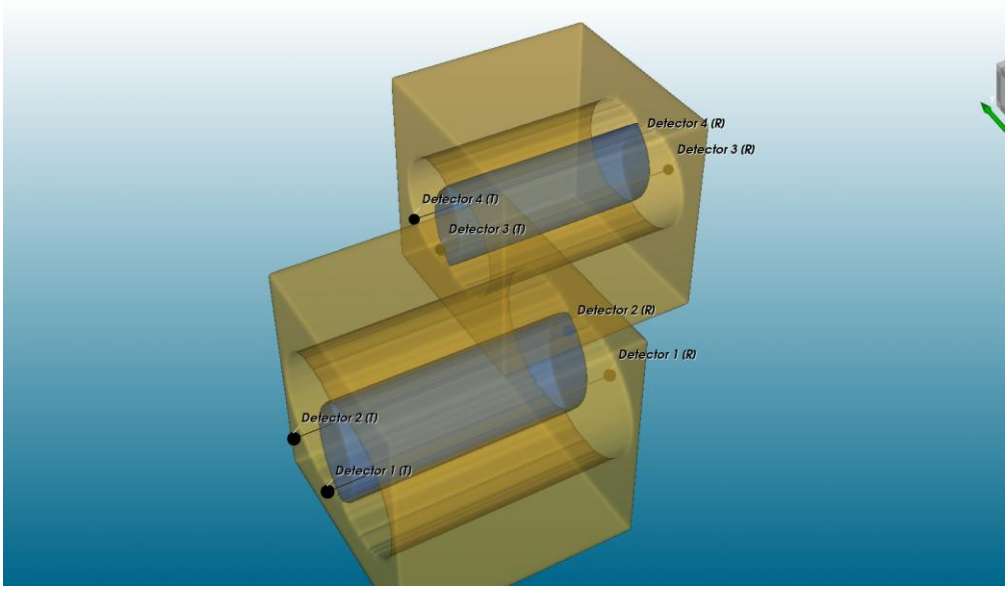
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	H2S	24 m	Grade D - Low 12 m / High 12 m Grade B - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2S	24 m	Grade D - Low 12 m / High 12 m Grade B - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2S	24 m	Grade D - Low 12 m / High 12 m Grade B - Low 10 m / High 10 m
Open Path Gas Detector (OPGD)	H2S	24 m	Grade D - Low 12 m / High 12 m Grade B - Low 10 m / High 10 m

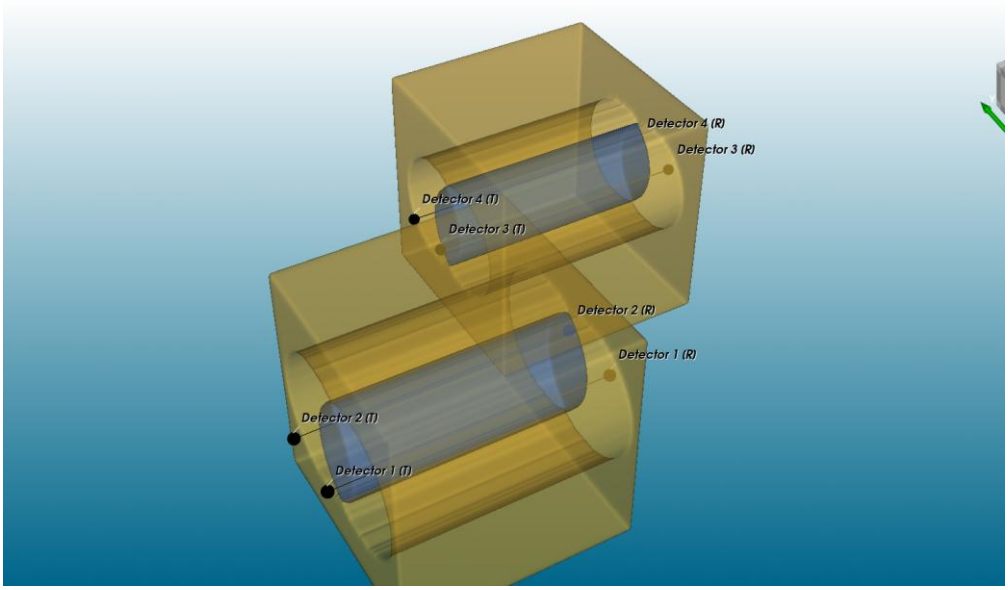
Analytical Formula: $(1.228 \times R^2 \times (\text{Range}-4)) / 40$

Coverage Results

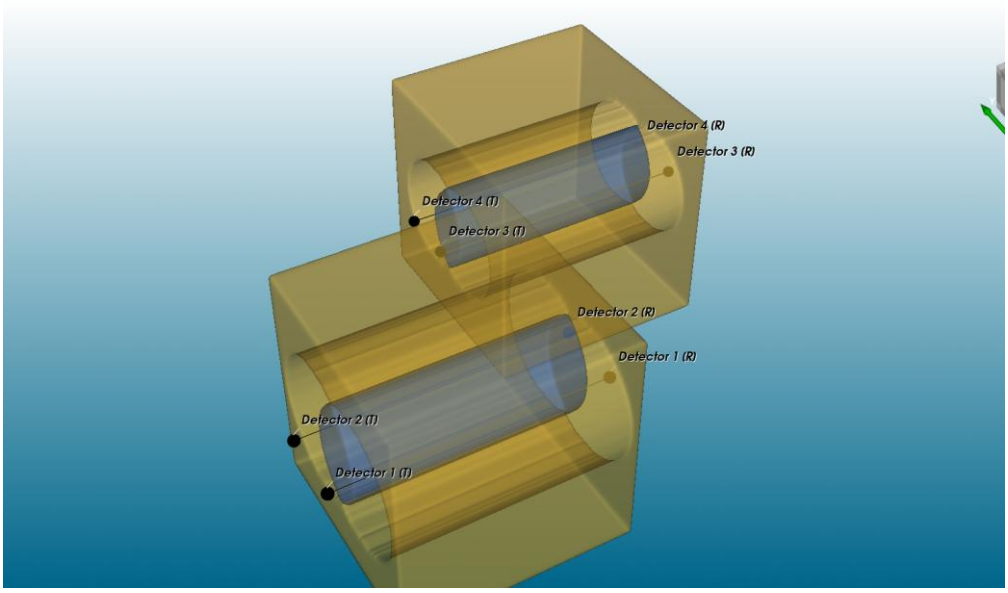
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	2ooN	LL	11.05	11.03	0.02
Grade B	2ooN	LL	7.67	7.66	0.01
Grade D	2ooN	LH	11.05	11.03	0.02
Grade B	2ooN	LH	7.67	7.66	0.01
Grade D	2ooN	HH	11.05	11.03	0.02
Grade B	2ooN	HH	7.67	7.66	0.01



View 1 - LL



View 1 - LH


Detector 4 (R)
Detector 3 (R)
Detector 4 (T)
Detector 3 (T)
Detector 2 (R)
Detector 1 (R)
Detector 2 (T)
Detector 1 (T)

View 1 - HH

6.3.12 Two grades overlapping each other. One PGD with its FOI completely inside both the grades simultaneously.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

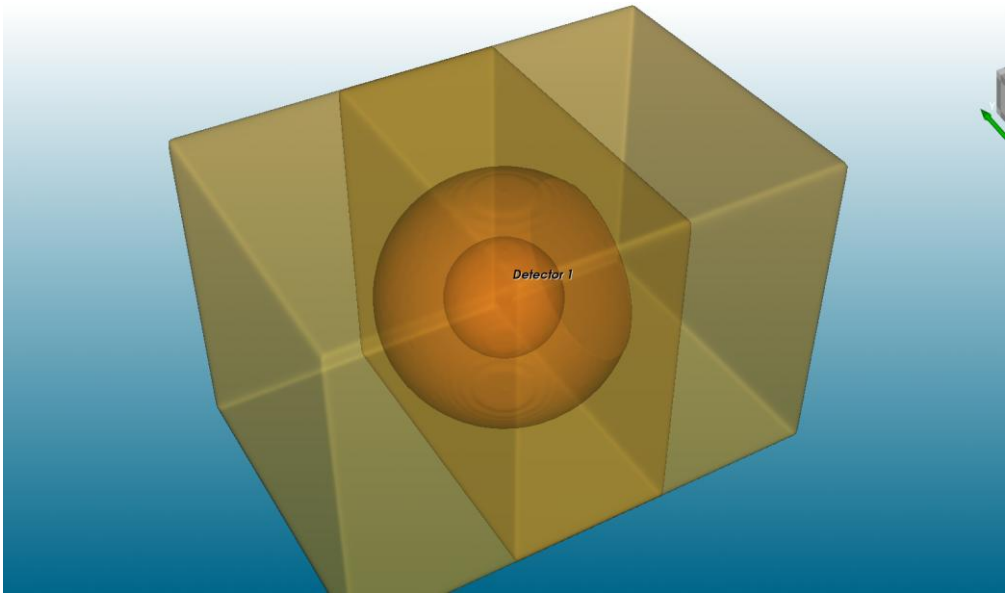
Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade D - Low 15 m / High 10 m Grade B - Low 7 m / High 5 m

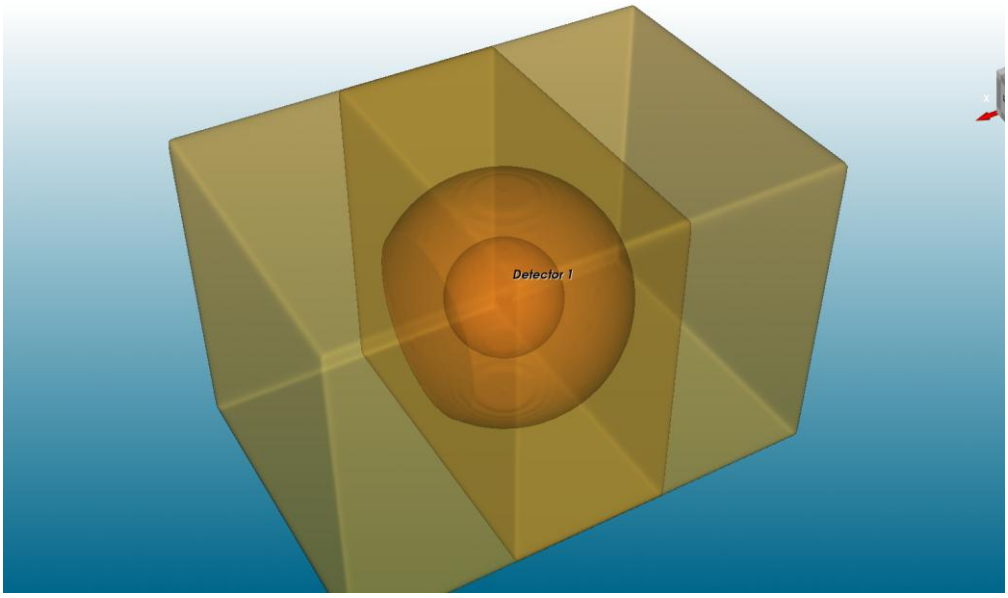
Analytical Formula: $(\pi \times h^2 \times (3R-h)) / 240$ (h = height of capped sphere, R = sphere radius)

Coverage Results

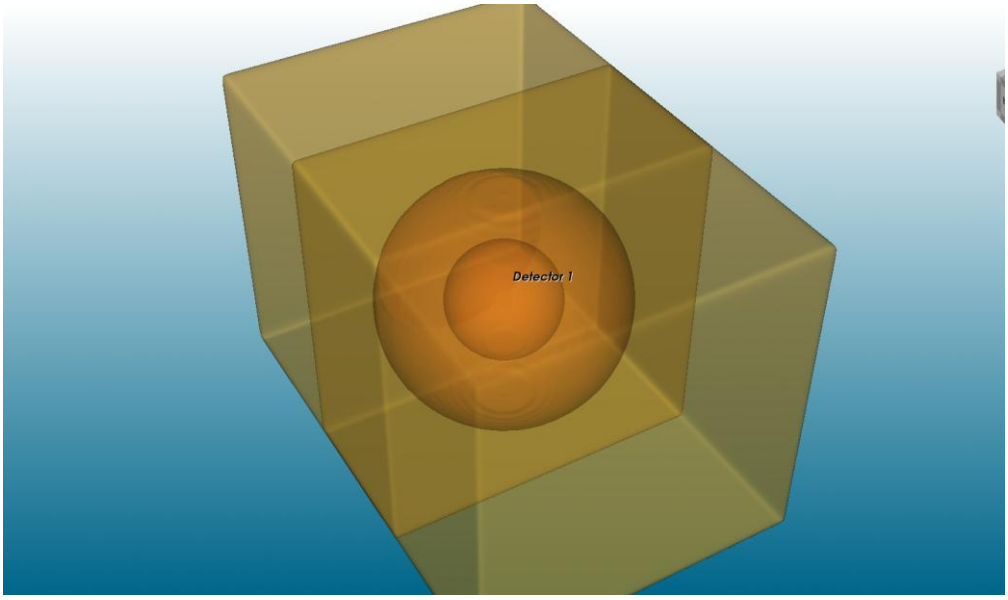
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	20.45	20.44	0.01
Grade B	1ooN	L	2.24	2.24	0.00
Grade D	1ooN	H	6.54	6.53	0.01
Grade B	1ooN	H	0.81	0.82	0.01



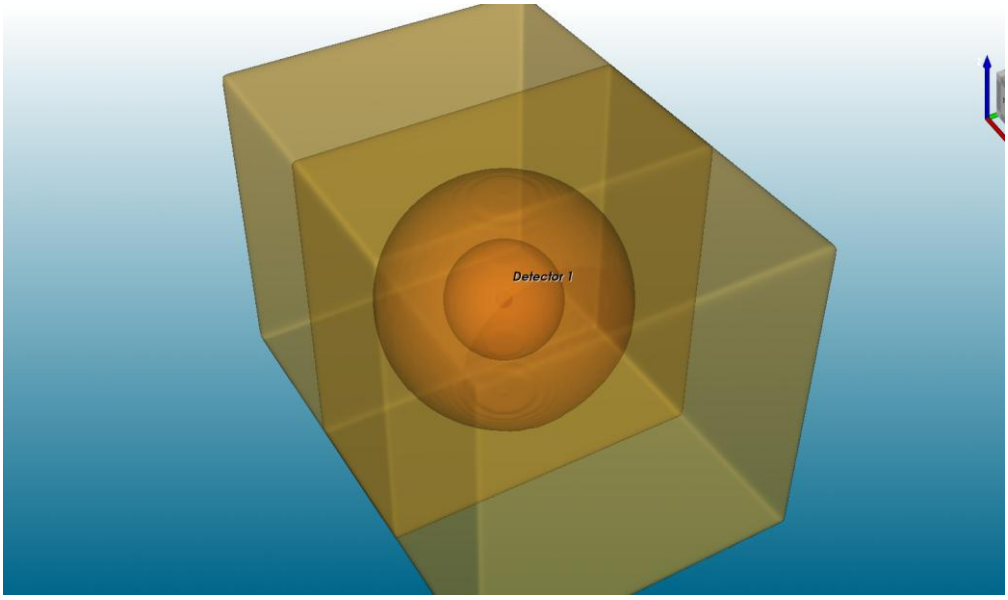
View 1 - L



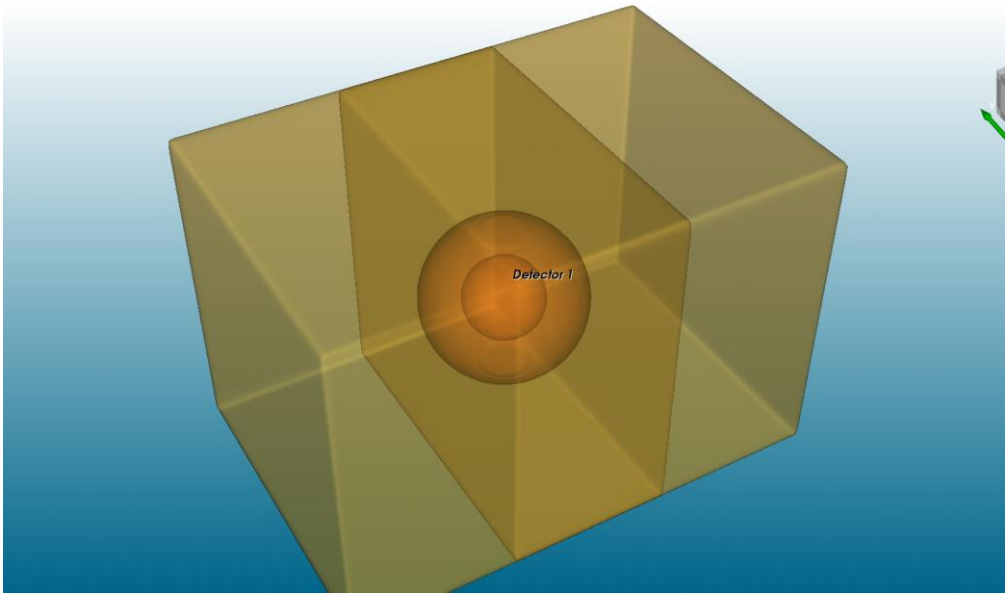
View 2 - L



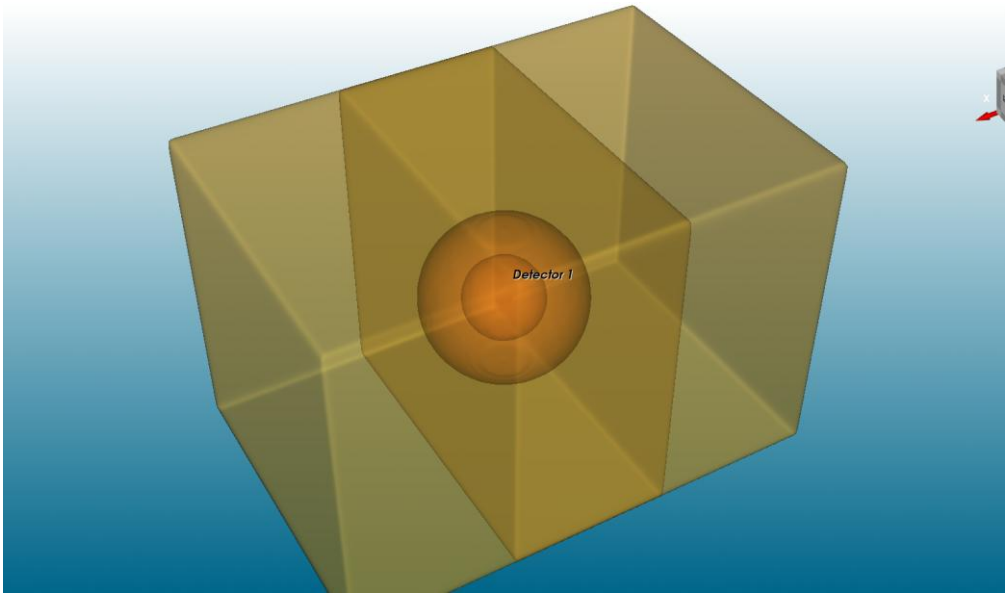
View 3 - L



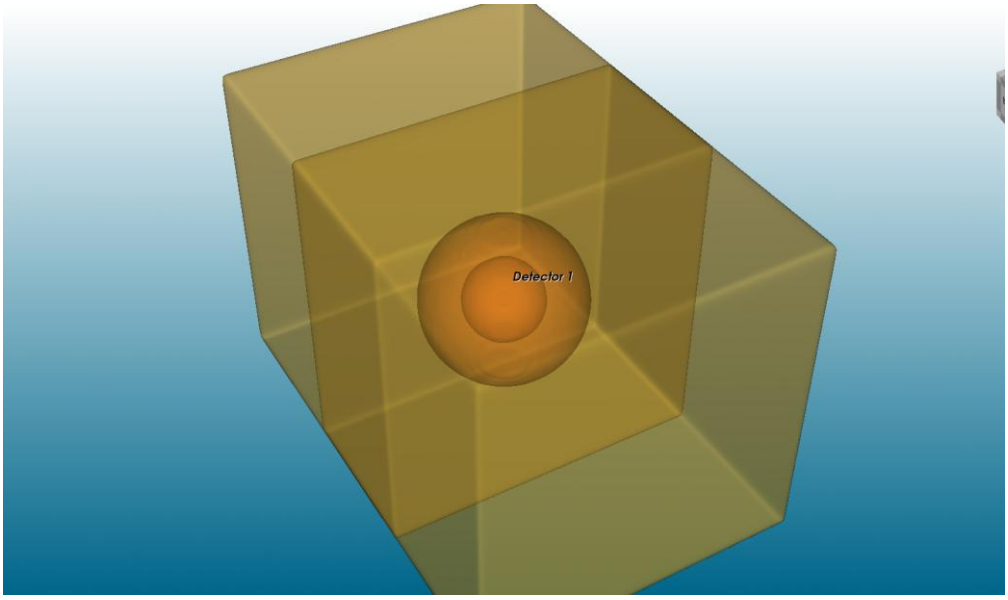
View 4 - L



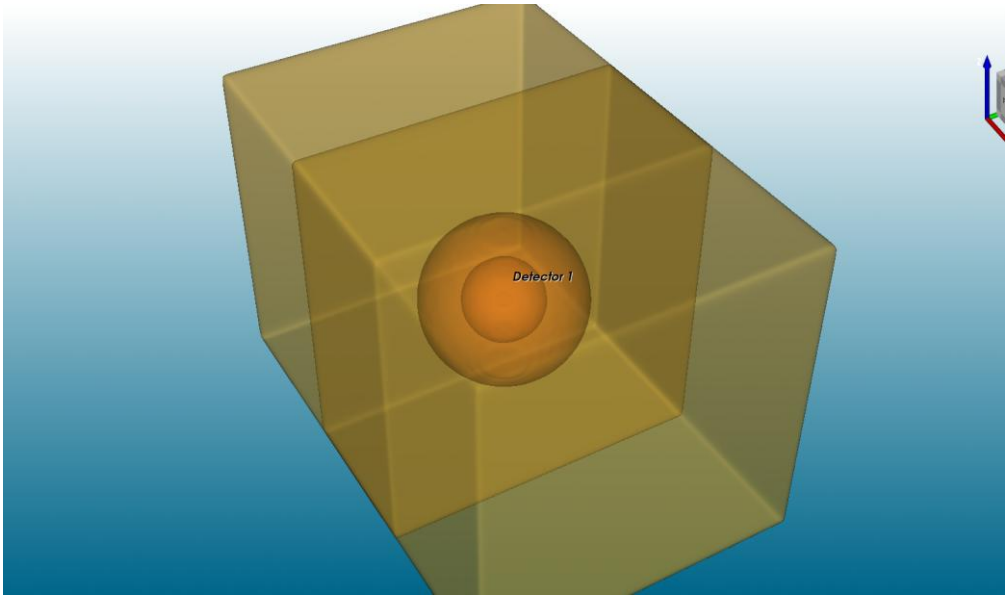
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.3.13 Two grades separated by 2m distance along with a PGD placed in between the two grades. The same detector's FOI is automatically treated differently in the two grades.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

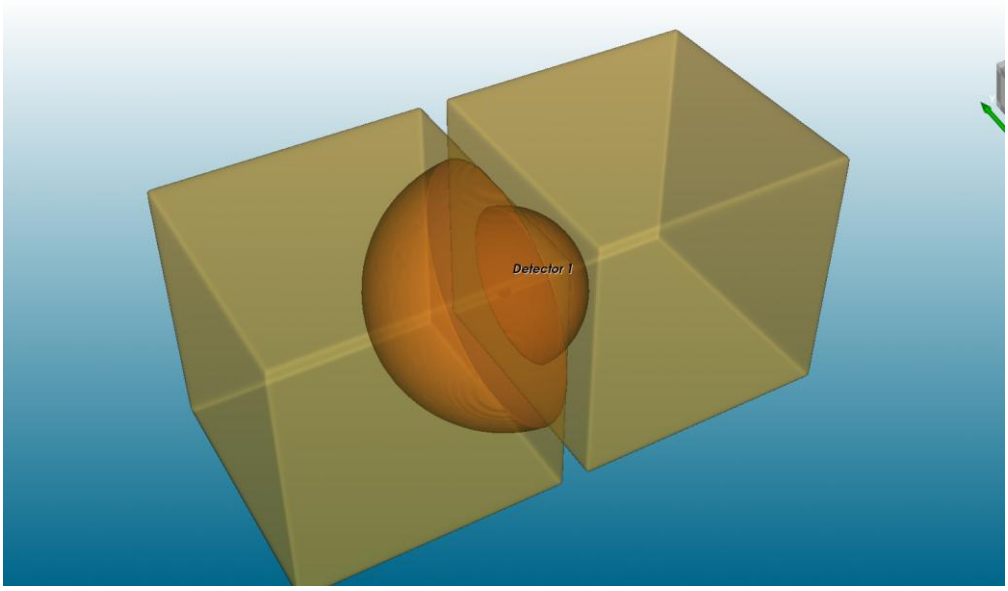
Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade D - Low 20 m / High 15 m Grade C - Low 12 m / High 10 m

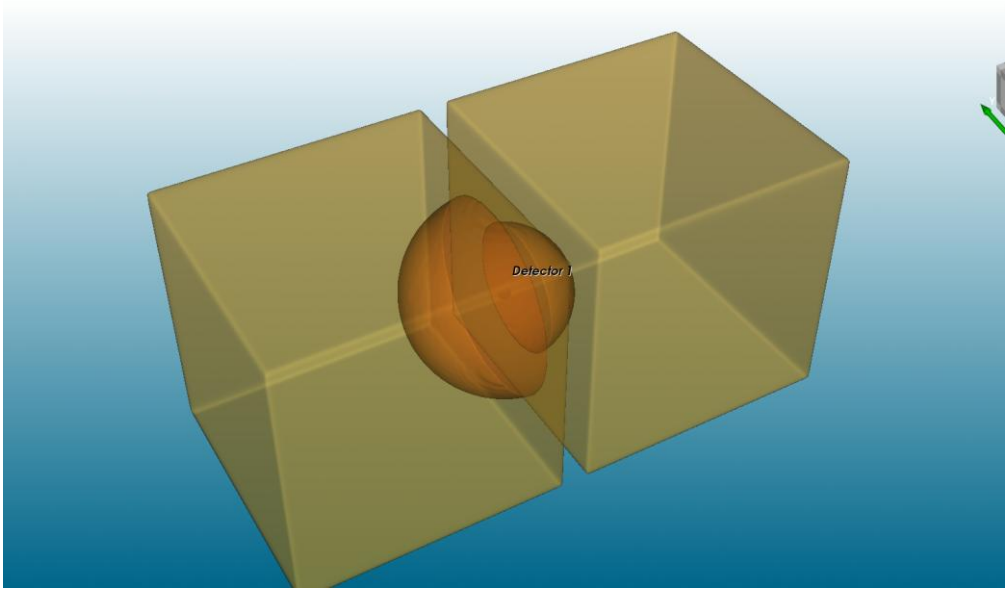
Analytical Formula: $(\pi \times h^2 \times (3R-h)) / 240$ (h = height of capped sphere, R = sphere radius)

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	22.26	22.26	0.00
Grade C	1ooN	L	4.25	4.25	0.00
Grade D	1ooN	H	8.84	8.85	0.01
Grade C	1ooN	H	2.3	2.3	0.00



View 1 - L



View 1 - H

6.3.14 One PGD inside each cylindrical grade with its FOI completely inside the relelvant grade.

Risk Grades

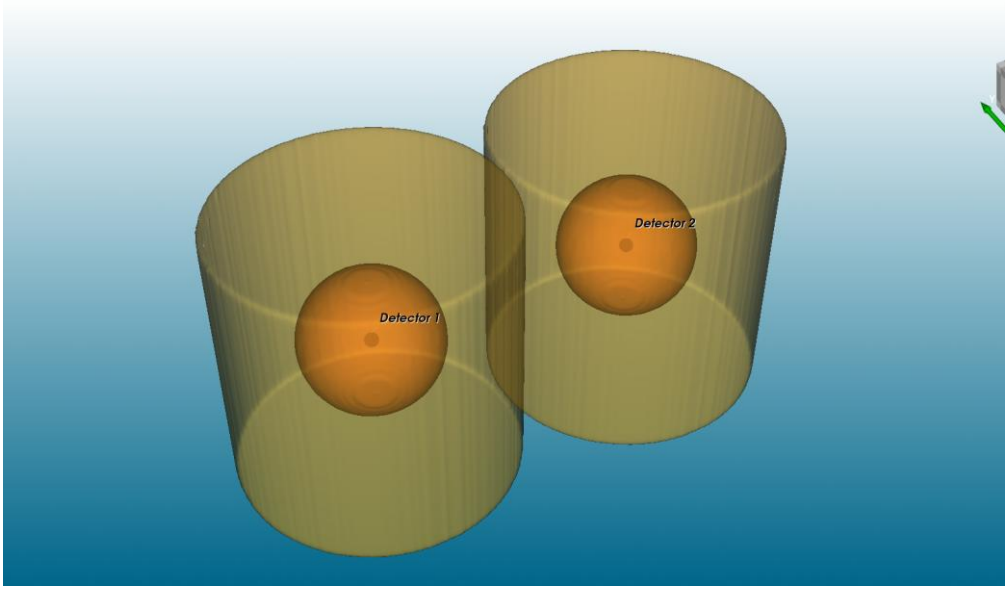
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade D
Cylinder	Radius 10 m, Height 20 m	Grade C

Gas Detectors

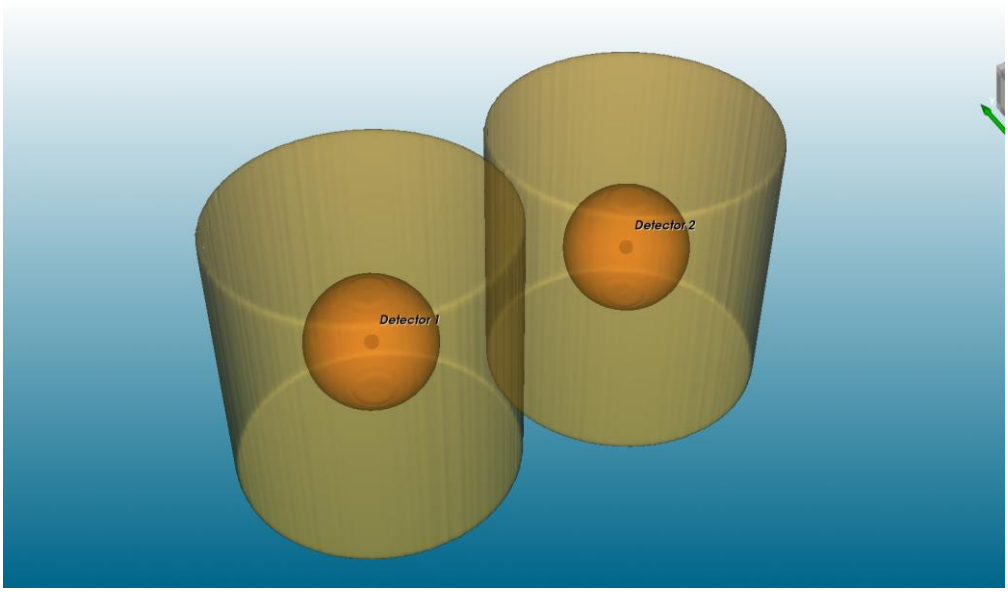
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	H2S	Grade D - Low 10 m / High 9 m Grade C - Low 10 m / High 9 m
Point Gas Detector (PGD)	H2S	Grade D - Low 10 m / High 9 m Grade C - Low 10 m / High 9 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	8.33	8.33	0.00
Grade C	1ooN	L	8.33	8.33	0.00
Grade D	1ooN	H	6.08	6.08	0.00
Grade C	1ooN	H	6.08	6.08	0.00



View 1 - L



View 1 - H

6.4 Cross Credit Validation

6.4.1 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

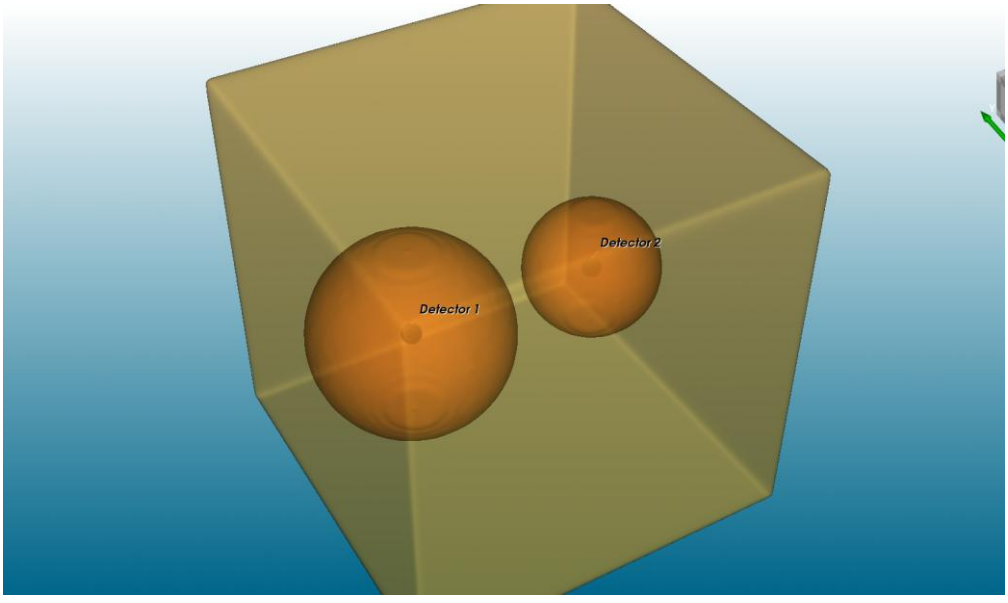
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

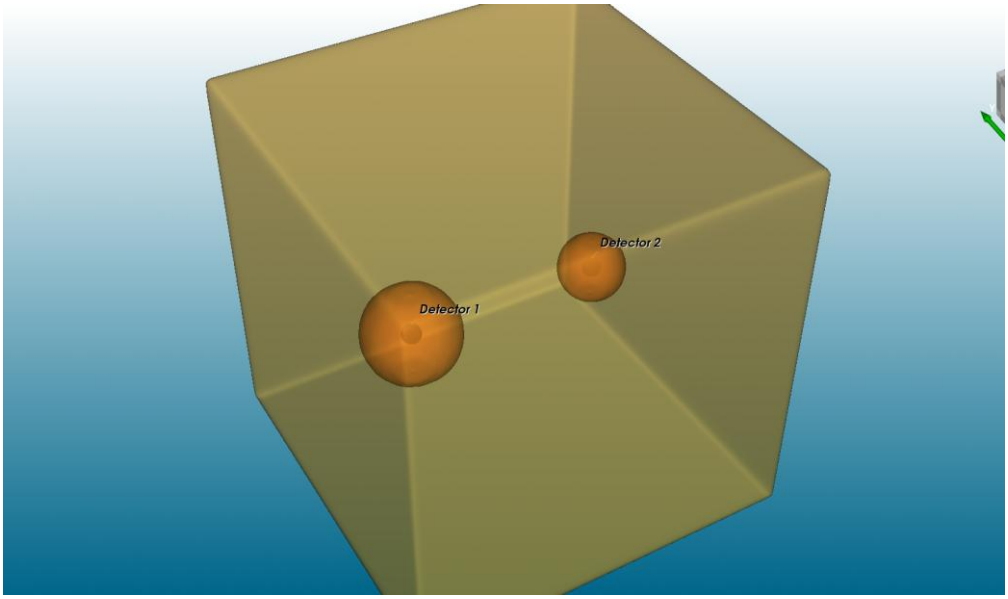
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2S	Grade D - Low 7 m / High 3.5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	8.79	8.78	0.01
Grade D	1ooN	H	1.1	1.1	0.00



View 1 - L



View 1 - H

6.4.2 One HC PGD and one H2S PGD with their FOI overlapping and completely inside a cubical grade. 2ooN coverage assessed.

Risk Grades

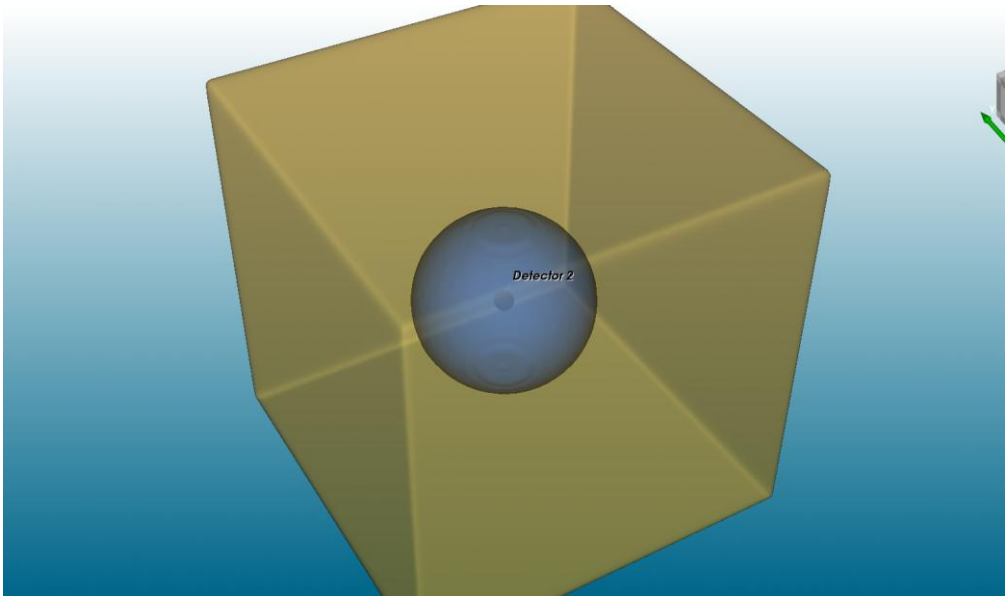
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

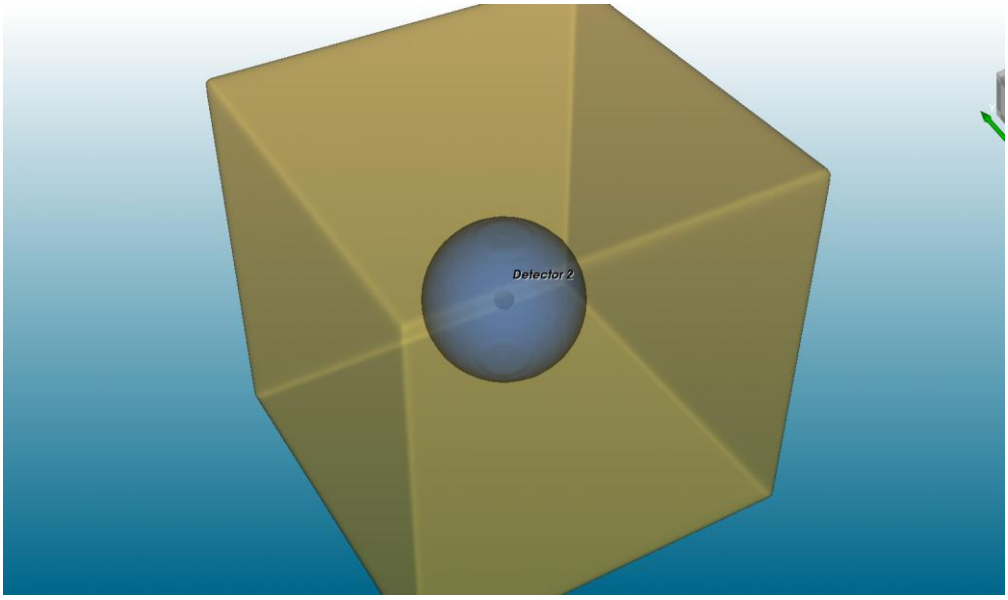
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade C - Low 10 m / High 8 m
Point Gas Detector (PGD)	H2S	Grade C - Low 9 m / High 7 m

Coverage Results

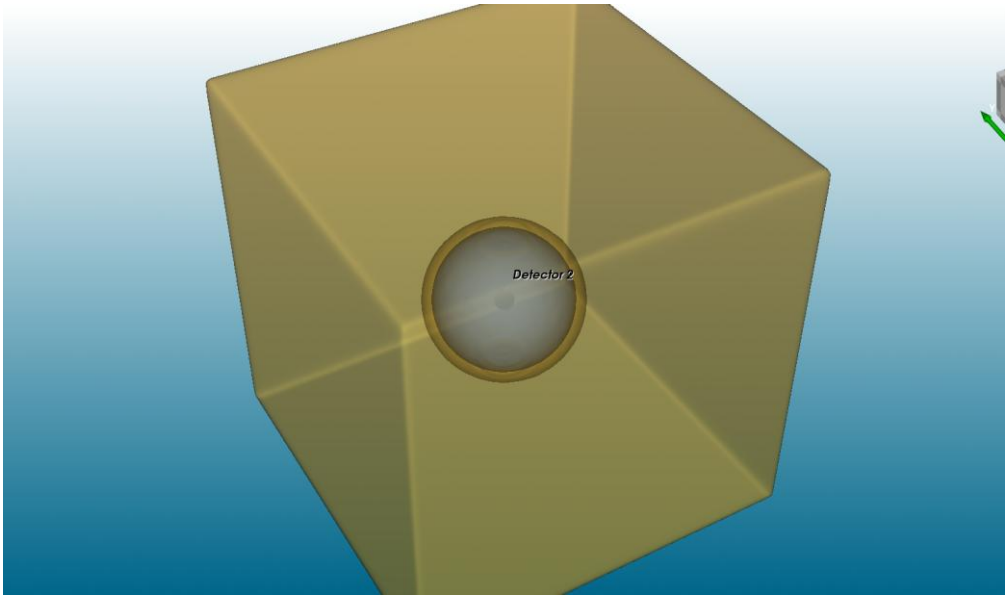
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	2ooN	LL	4.77	4.77	0.00
Grade C	2ooN	LH	3.35	3.34	0.01
Grade C	2ooN	HH	2.24	2.24	0.00



View 1 - LL



View 1 - LH



View 1 - HH

6.4.3 Three PGDs - one HC, one H2S and one H2 with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

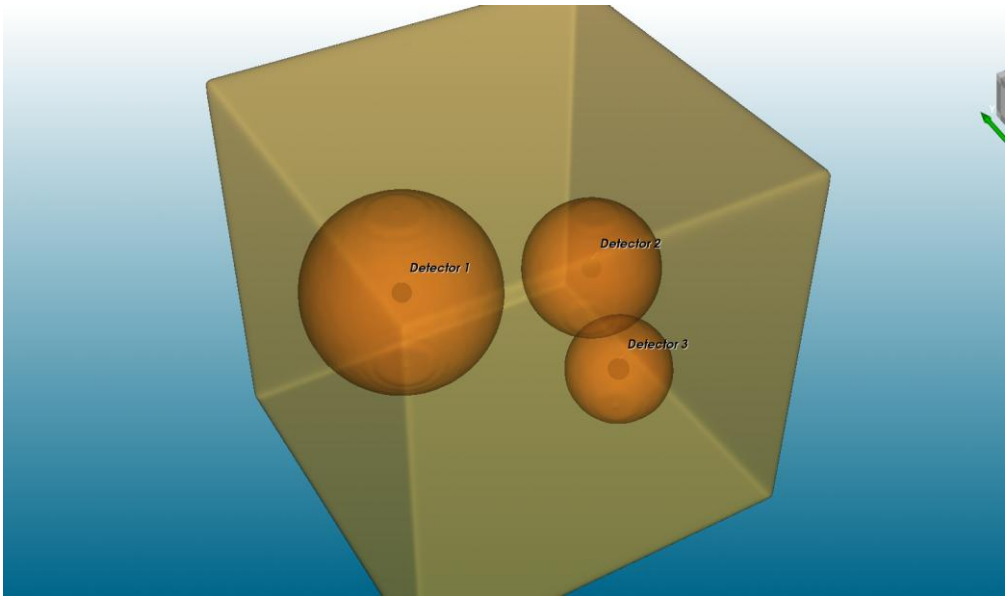
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

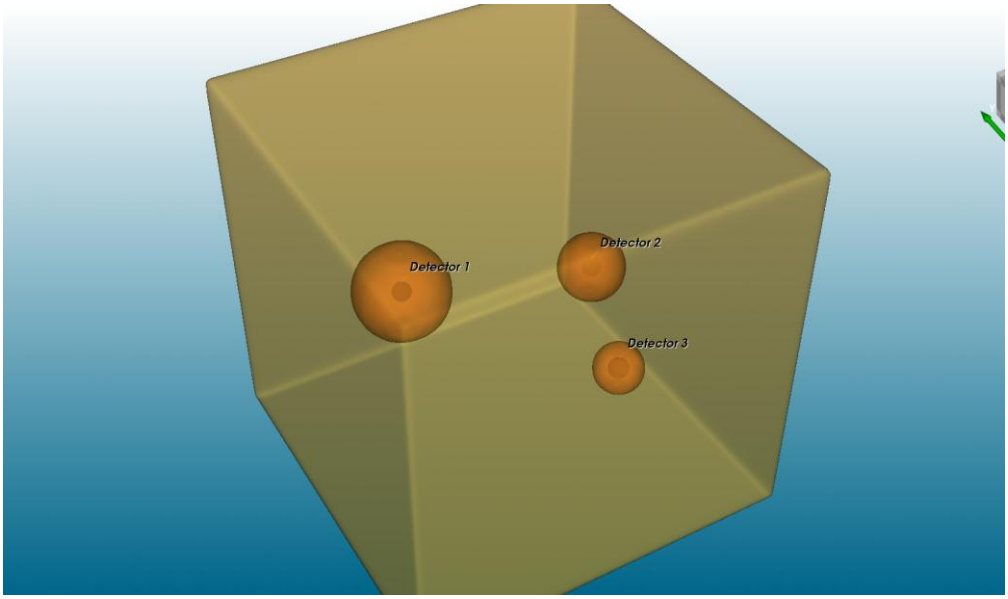
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade C - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2S	Grade C - Low 7 m / High 3.5 m
Point Gas Detector (PGD)	H2	Grade C - Low 5 m / High 2.5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	9.61	9.59	0.02
Grade C	1ooN	H	1.2	1.2	0.00



View 1 - L



View 1 - H

6.4.4 Three PGDs - one HC, one H2S and one H2 with their FOI completely inside a cubical grade. FOI of H2S and H2 PGDs overlap. 2ooN coverage assessed.

Risk Grades

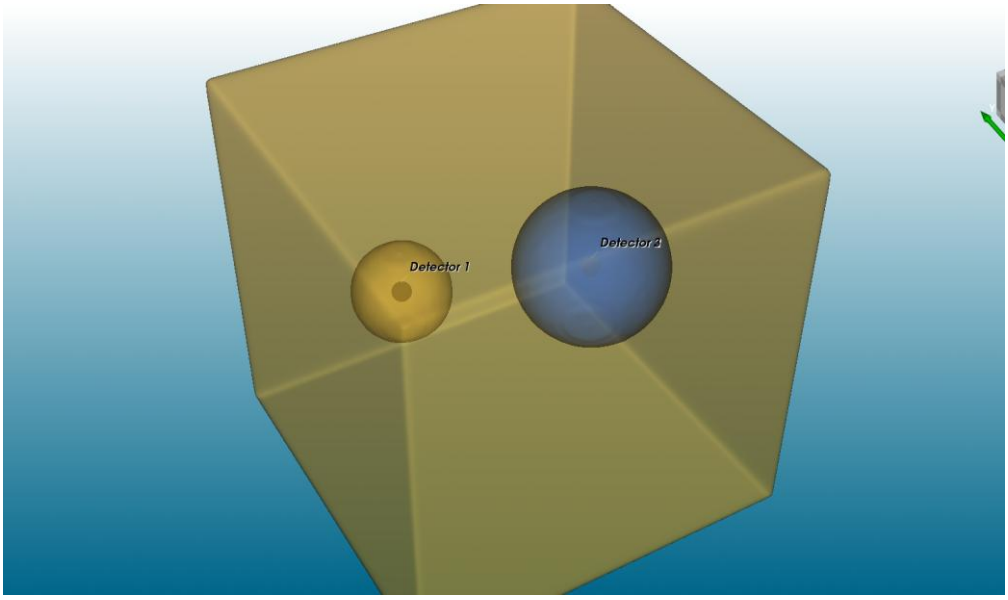
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

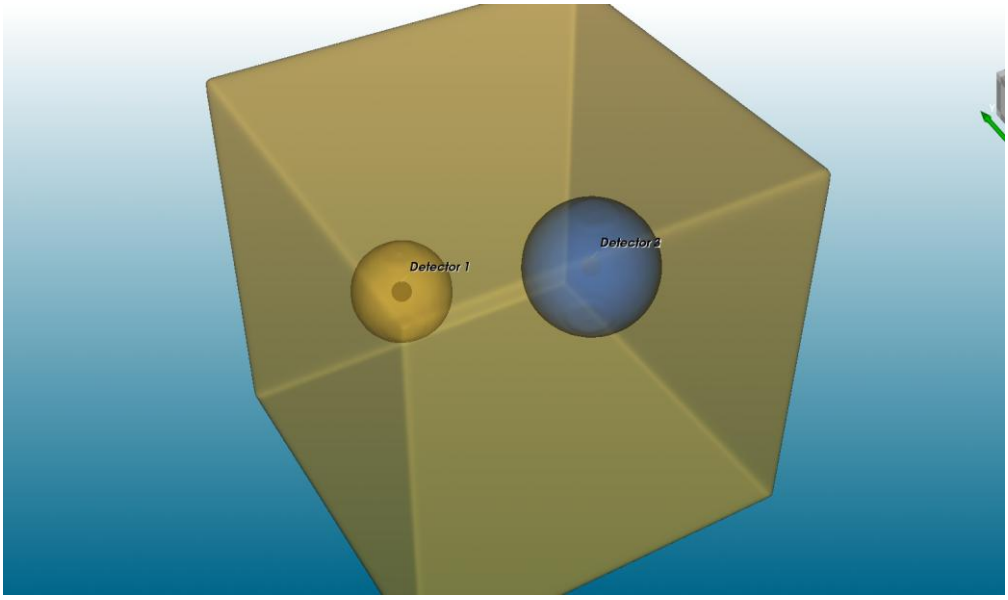
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2S	Grade B - Low 9 m / High 7 m
Point Gas Detector (PGD)	H2	Grade B - Low 8 m / High 6 m

Coverage Results

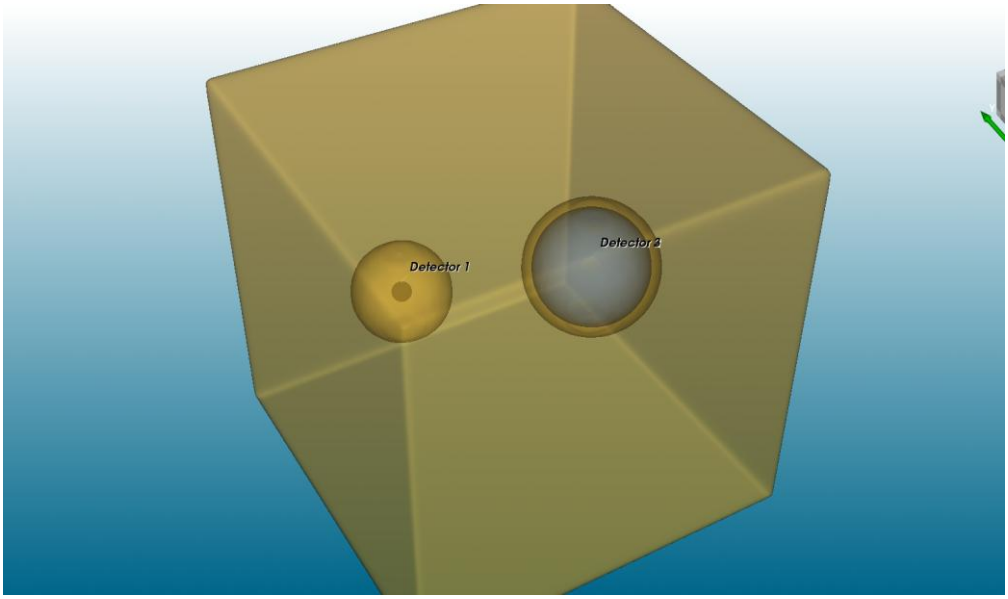
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	2ooN	LL	3.35	3.34	0.01
Grade B	2ooN	LH	2.24	2.24	0.00
Grade B	2ooN	HH	1.41	1.41	0.00



View 1 - LL



View 1 - LH



View 1 - HH

6.4.5 Three PGDs - one HC, one H2S and one H2 with their FOI overlapping and completely inside a cubical grade. 3ooN coverage assessed.

Risk Grades

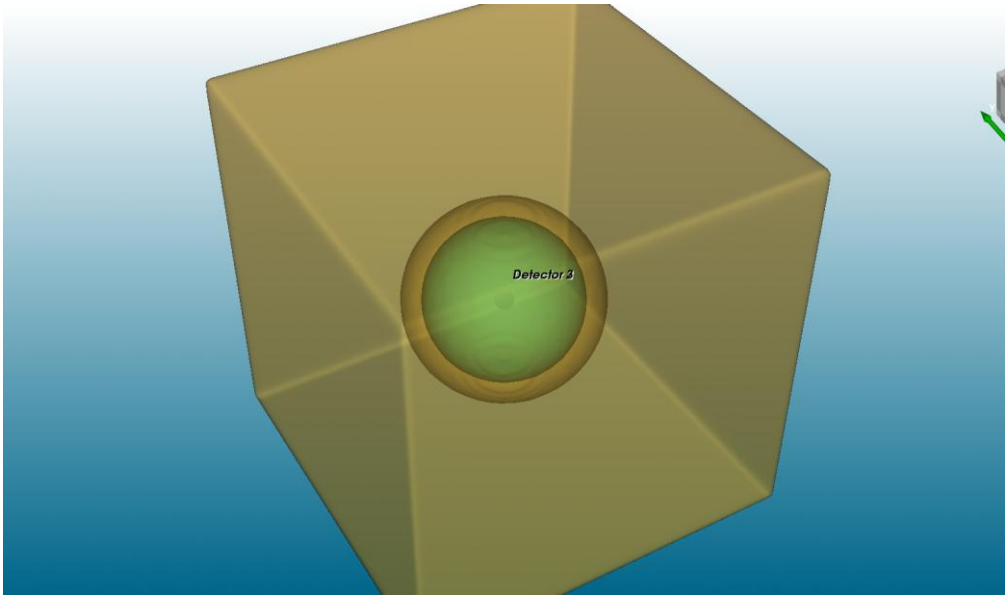
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

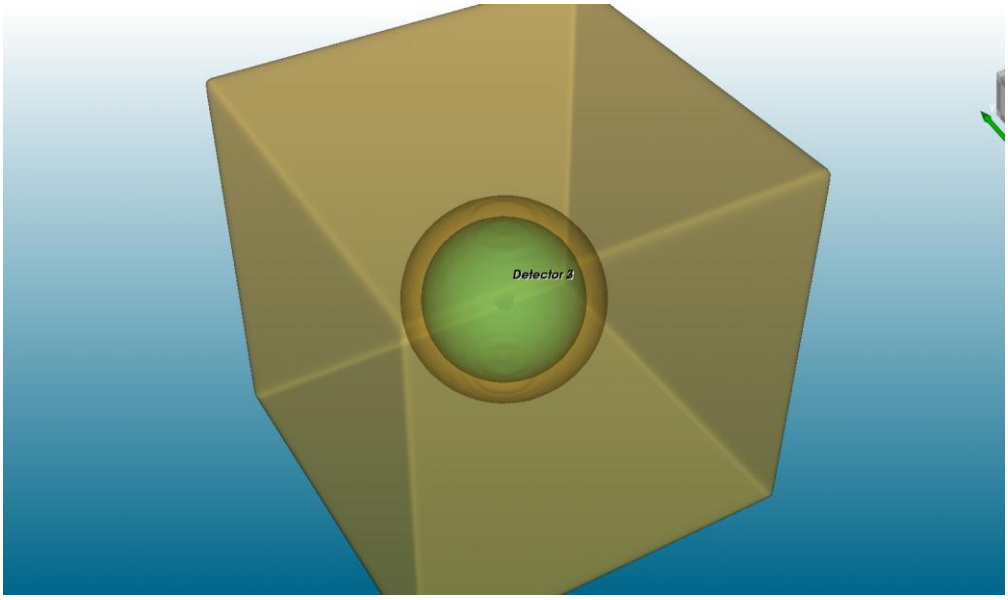
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 8 m
Point Gas Detector (PGD)	H2S	Grade B - Low 9 m / High 7 m
Point Gas Detector (PGD)	H2	Grade B - Low 8 m / High 6 m

Coverage Results

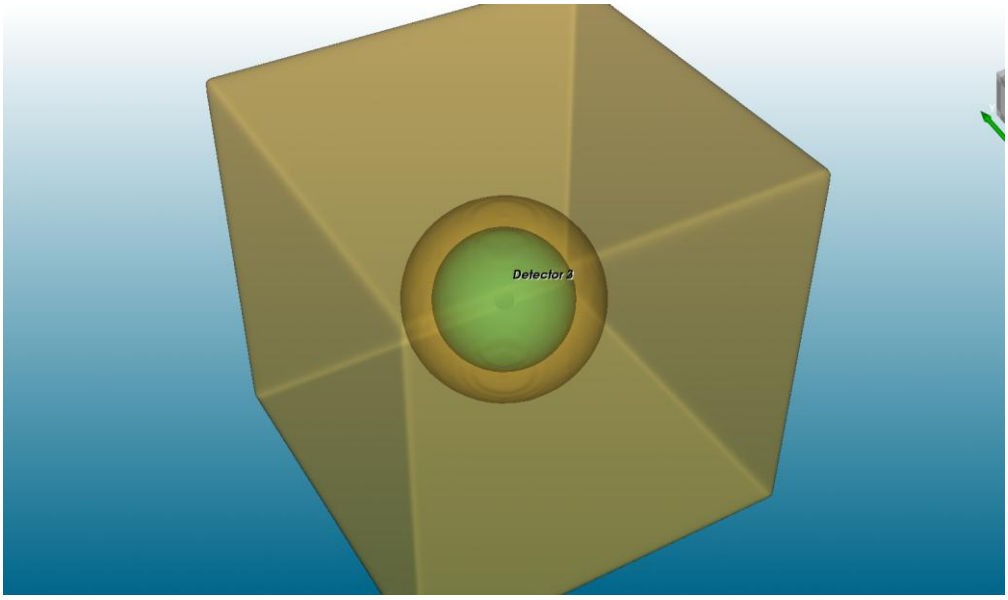
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	3ooN	LLL	3.35	3.34	0.01
Grade B	3ooN	LLH	3.35	3.34	0.01
Grade B	3ooN	LHH	2.24	2.24	0.00
Grade B	3ooN	HHH	1.41	1.41	0.00



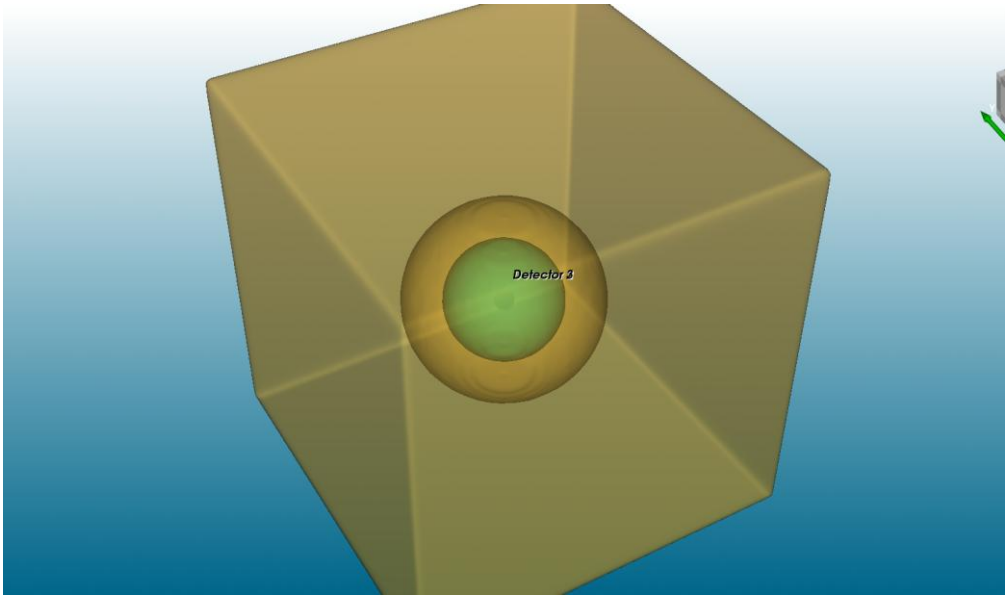
View 1 - LLL



View 1 - LLH



View 1 - LHH



View 1 - HHH

6.4.6 Four PGDs - three HC and one H2S with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

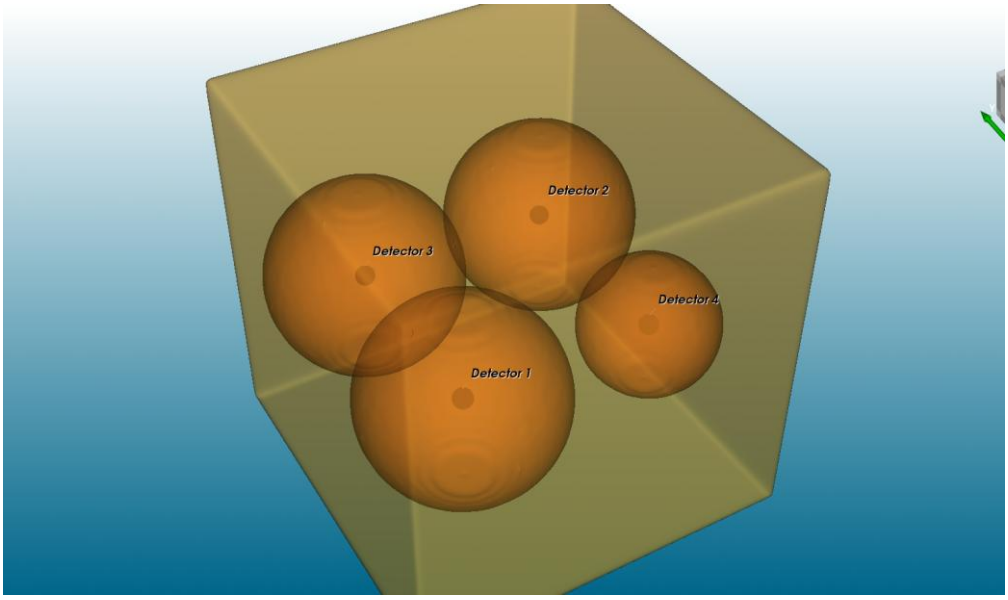
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

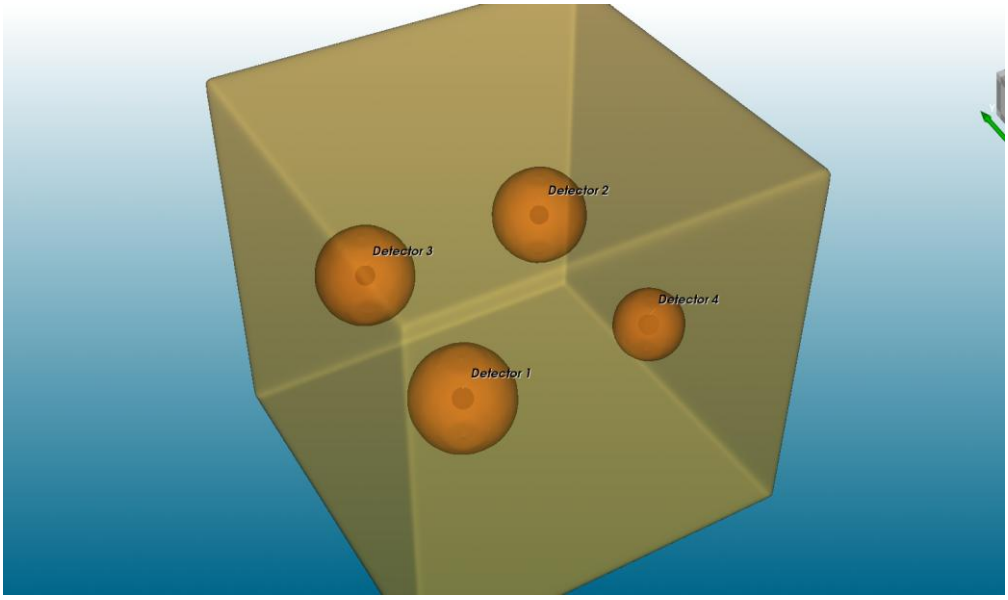
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade C - Low 10 m / High 5 m
Point Gas Detector (PGD)	HC	Grade C - Low 10 m / High 5 m
Point Gas Detector (PGD)	HC	Grade C - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2S	Grade C - Low 7 m / High 3.5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	21.88	21.84	0.04
Grade C	1ooN	H	2.73	2.73	0.00



View 1 - L



View 1 - H

6.4.7 Four PGDs - one HC and three H2S with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

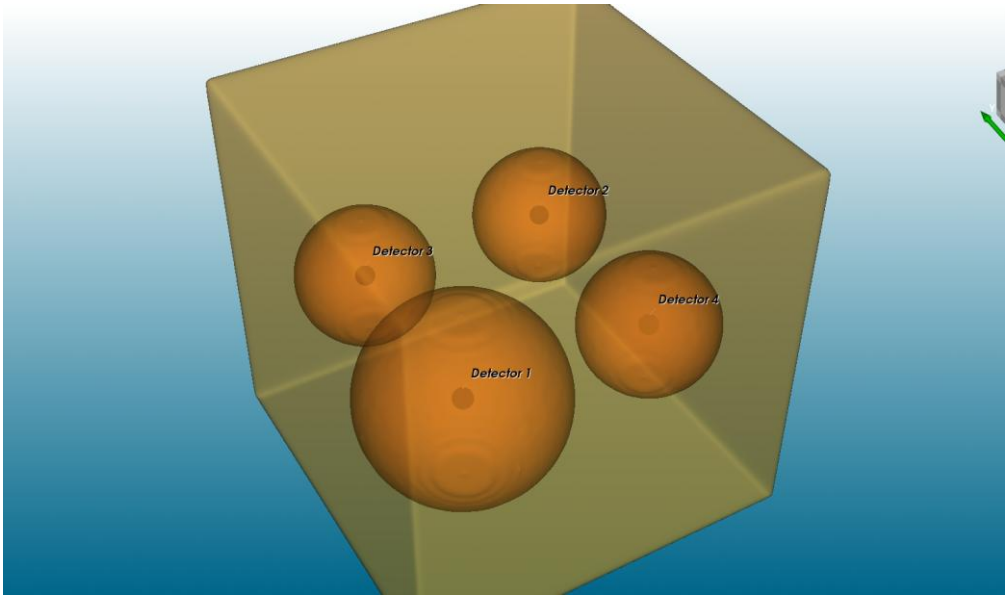
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

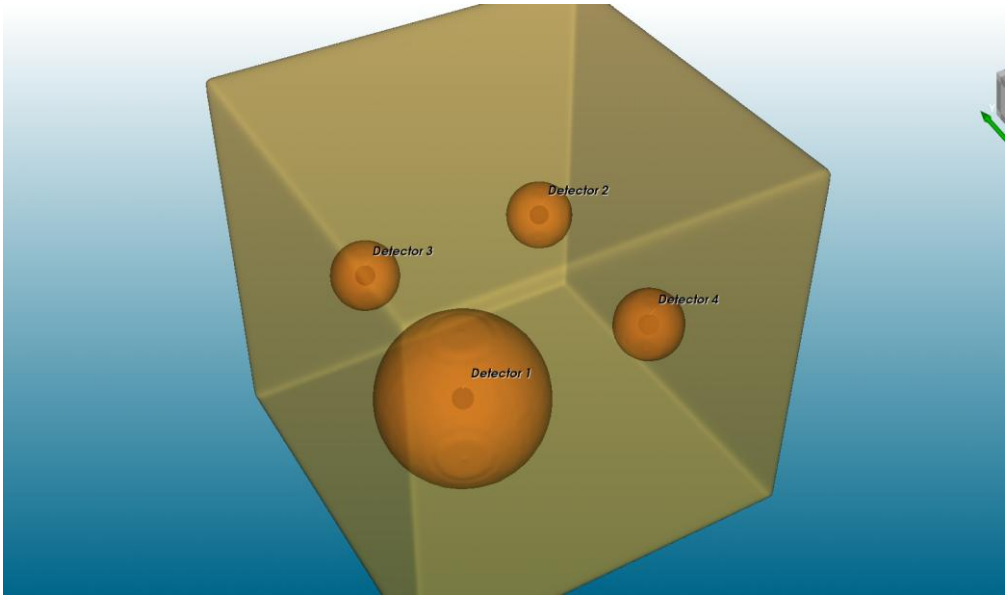
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - Low 10 m / High 8 m
Point Gas Detector (PGD)	H2S	Grade D - Low 7 m / High 3.5 m
Point Gas Detector (PGD)	H2S	Grade D - Low 7 m / High 3.5 m
Point Gas Detector (PGD)	H2S	Grade D - Low 7 m / High 3.5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	13.28	13.26	0.02
Grade D	1ooN	H	4.19	4.19	0.00



View 1 - L



View 1 - H

6.4.8 Two OPGDs - one HC and one H2S with their FOI non-intersecting and completely inside a cubical grade.

Risk Grades

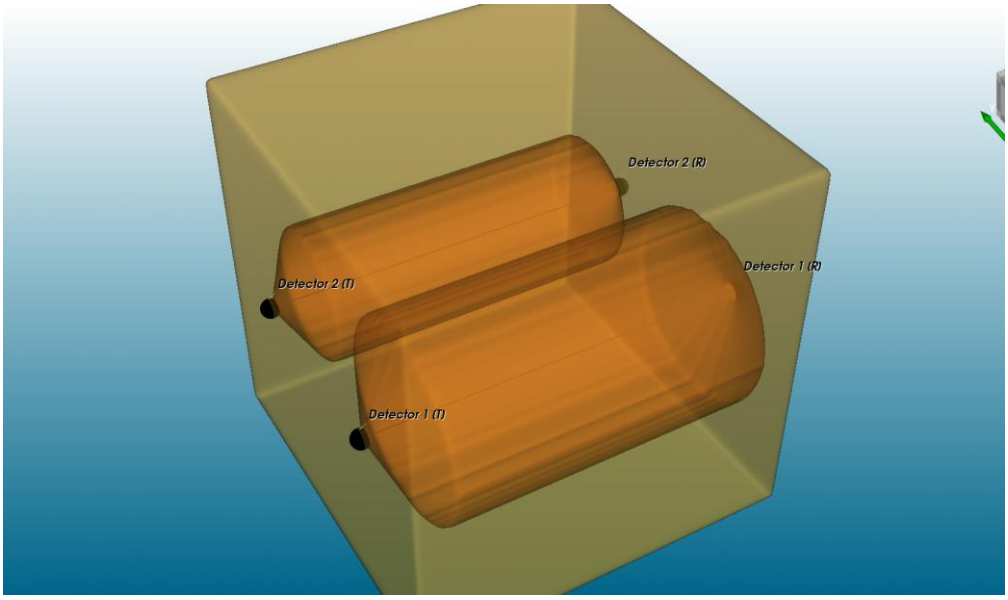
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

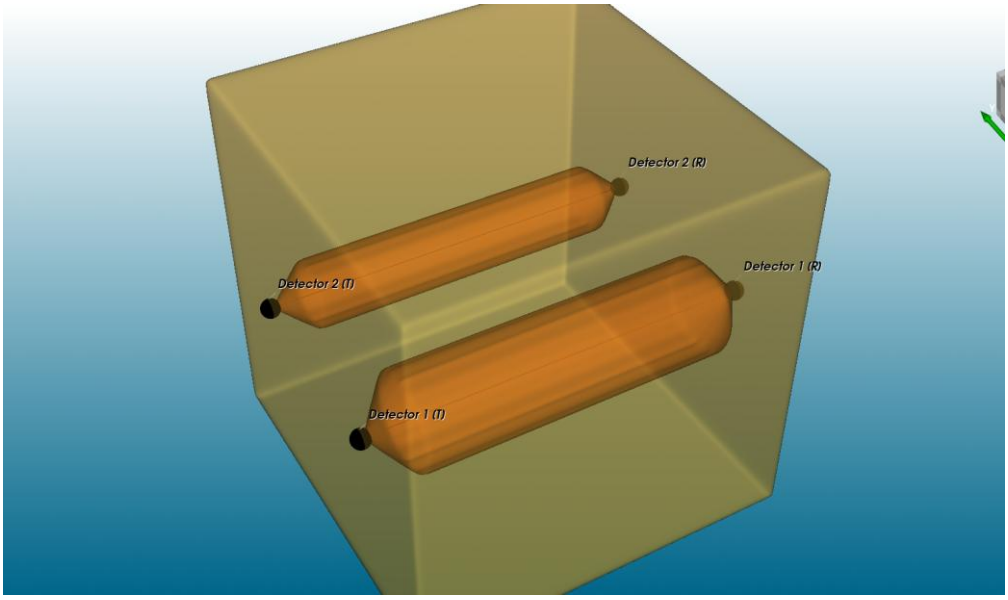
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade B - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade B - Low 7 m / High 3.5 m

Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	25.36	25.2	0.16
Grade B	1ooN	H	6.34	6.27	0.07



View 1 - L



View 1 - H

6.5 Validation with Geometry

6.5.1 One Point Gas Detector (PGD) with its Field of Influence (FOI) completely inside a cubical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

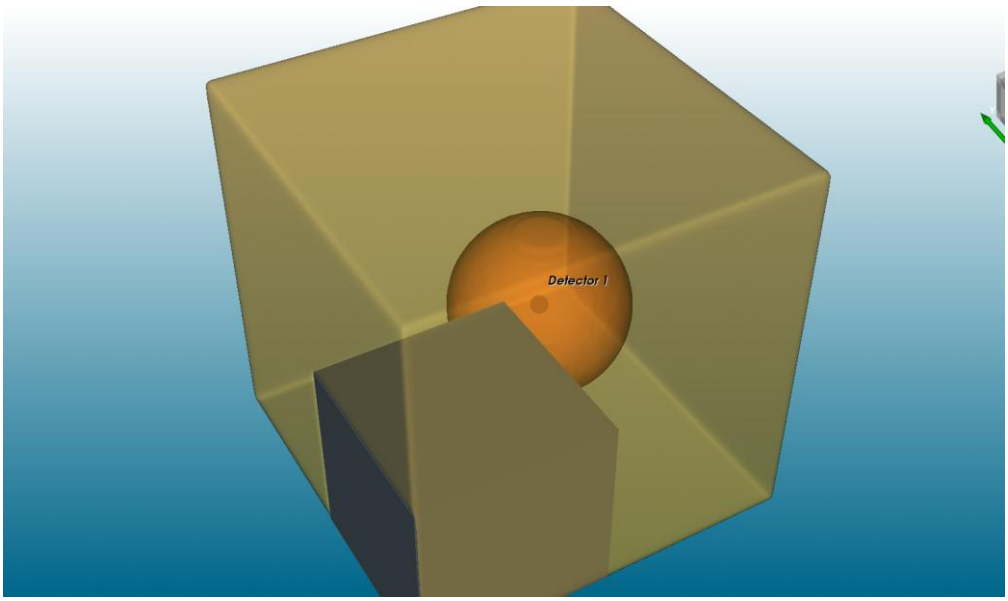
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

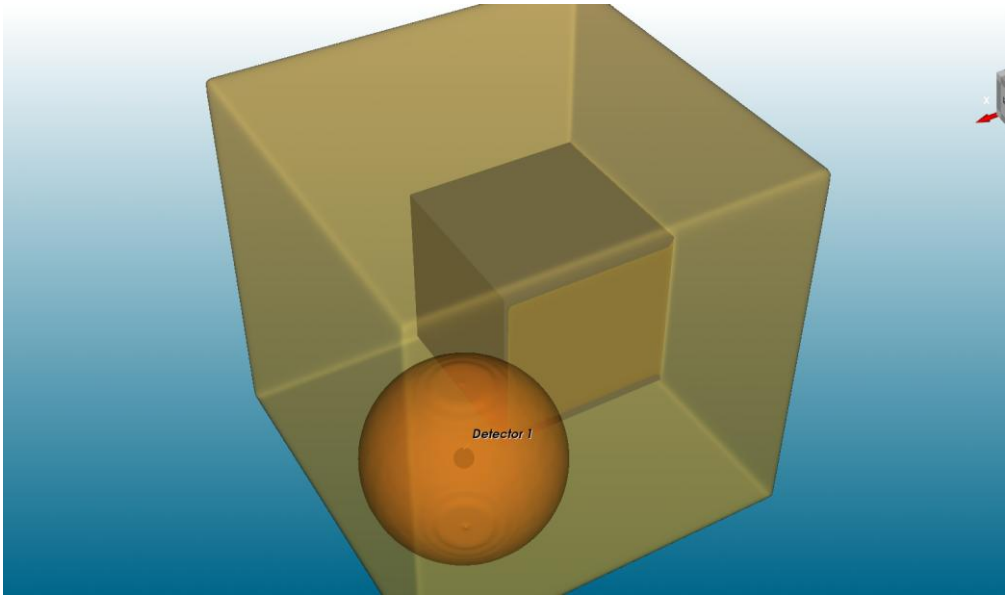
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 8 m

Coverage Results

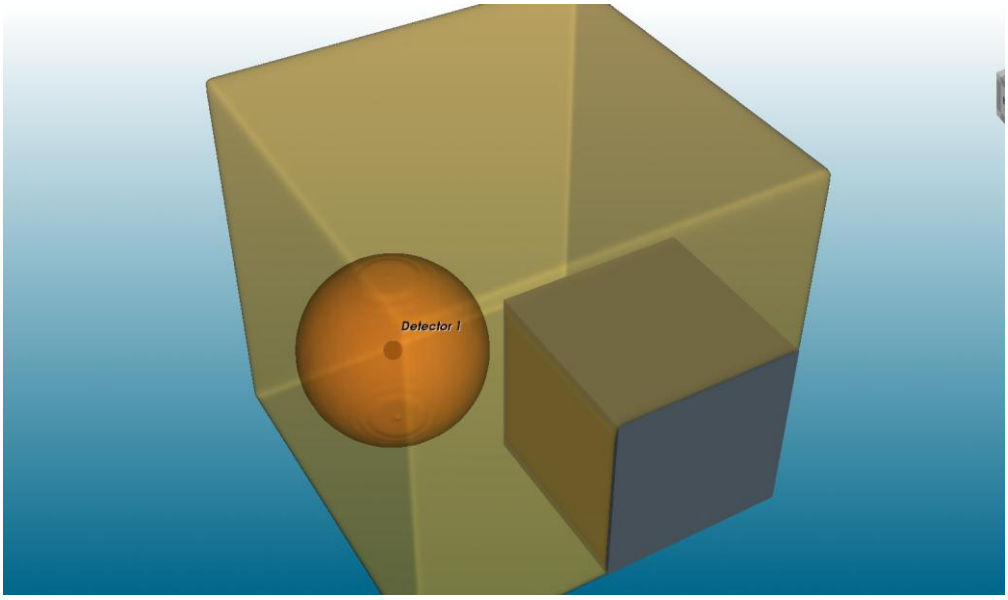
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	7.48	7.44	0.04
Grade B	1ooN	H	3.83	3.8	0.03



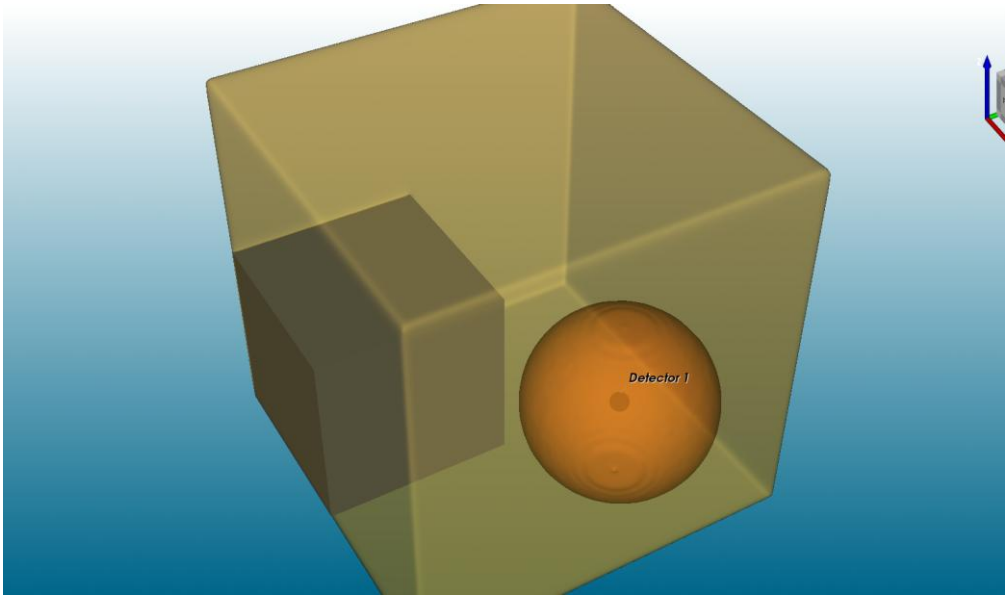
View 1 - L



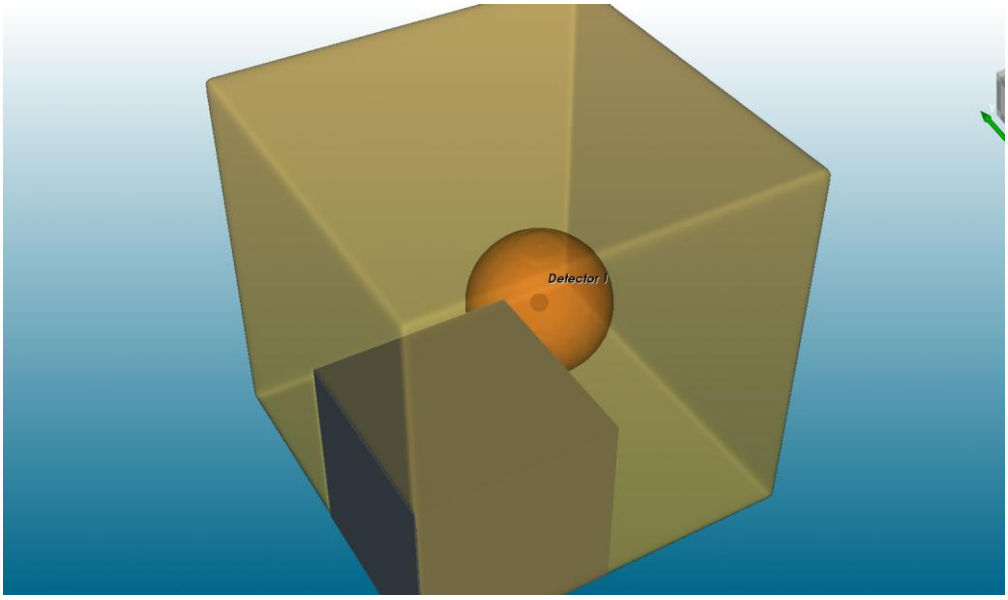
View 2 - L



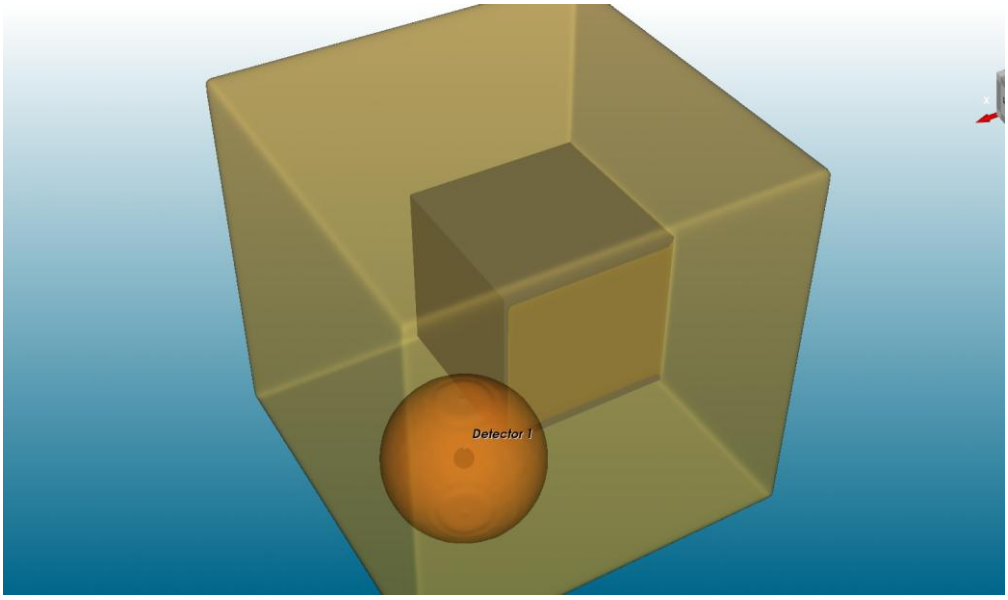
View 3 - L



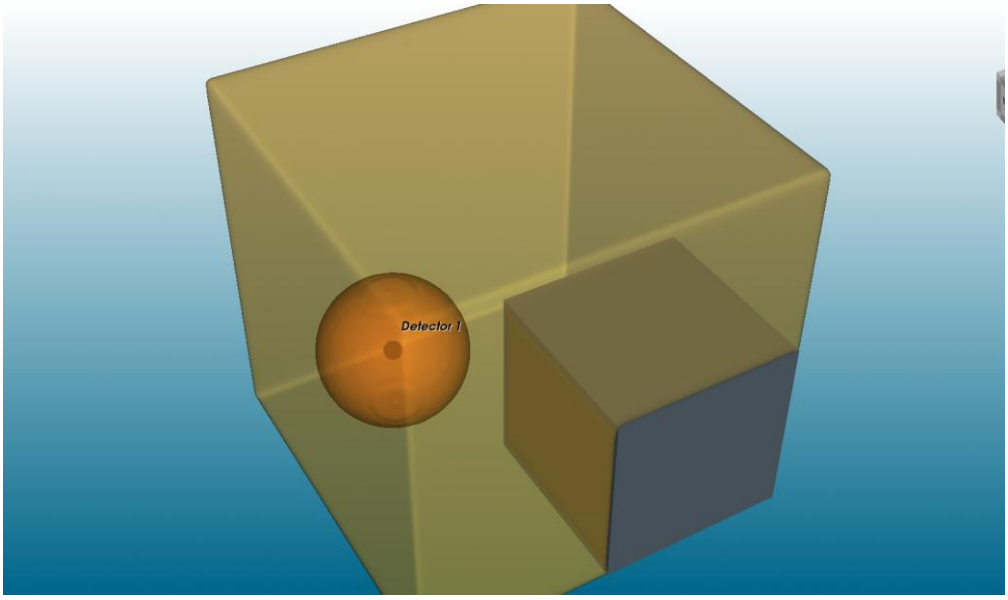
View 4 - L



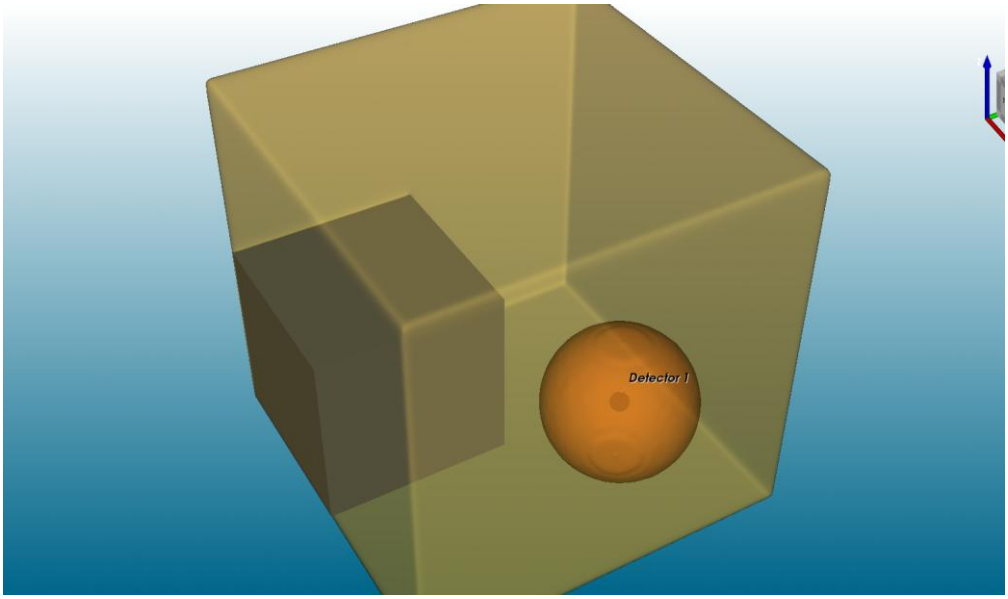
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.2 One PGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

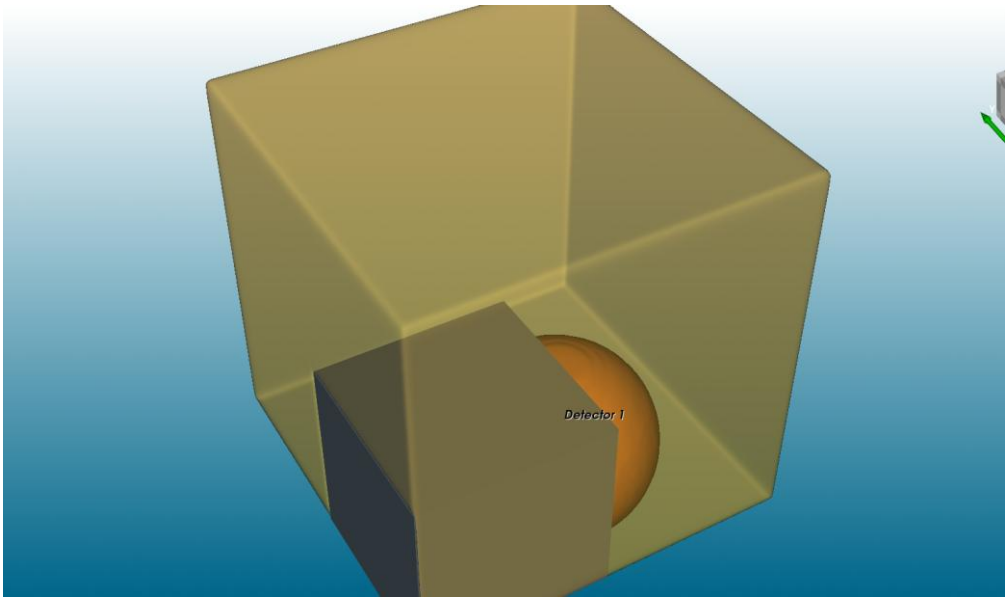
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

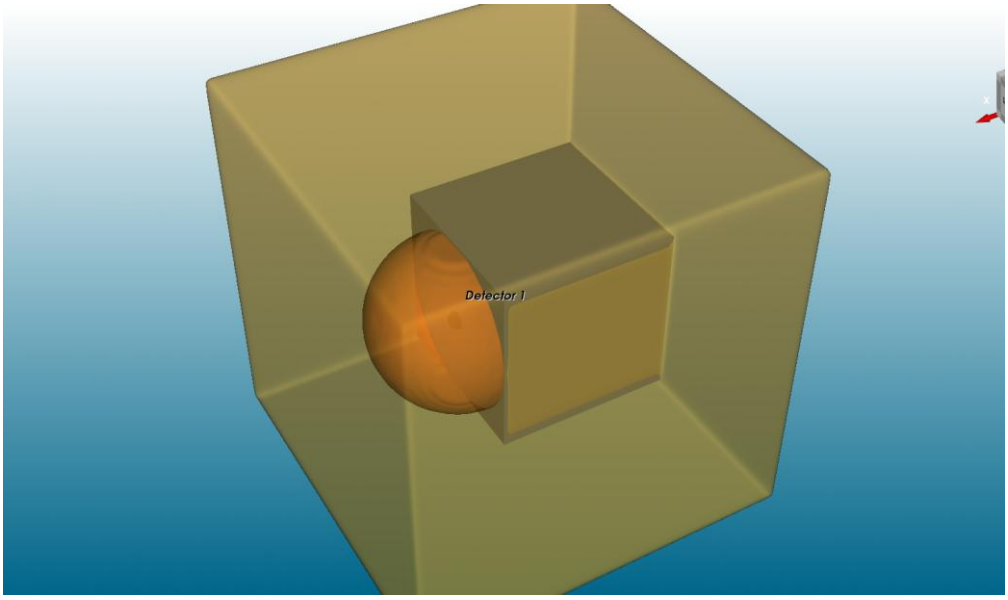
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - Low 10 m / High 8 m

Coverage Results

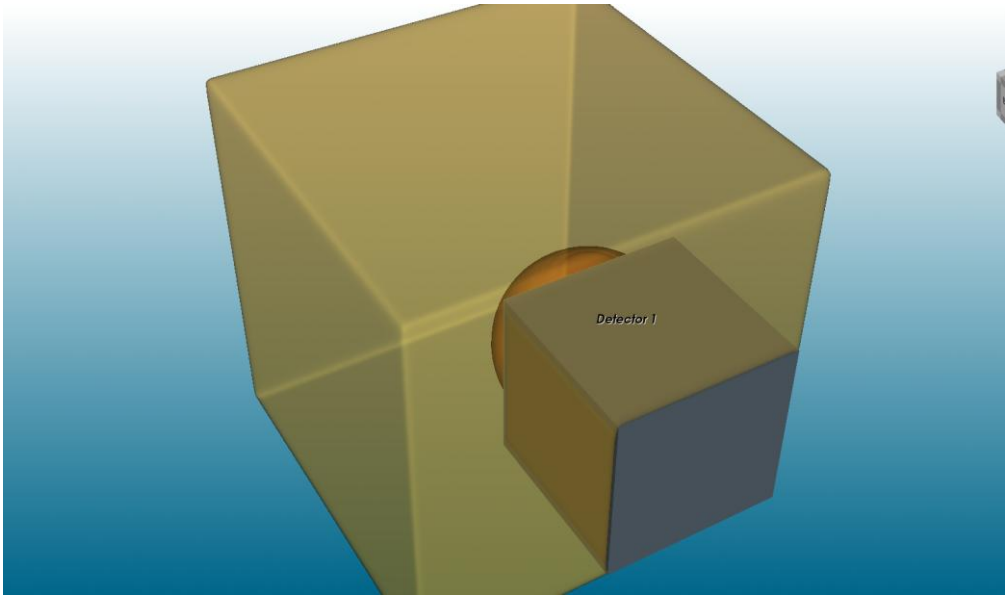
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	3.74	3.78	0.04
Grade D	1ooN	H	1.91	1.94	0.03



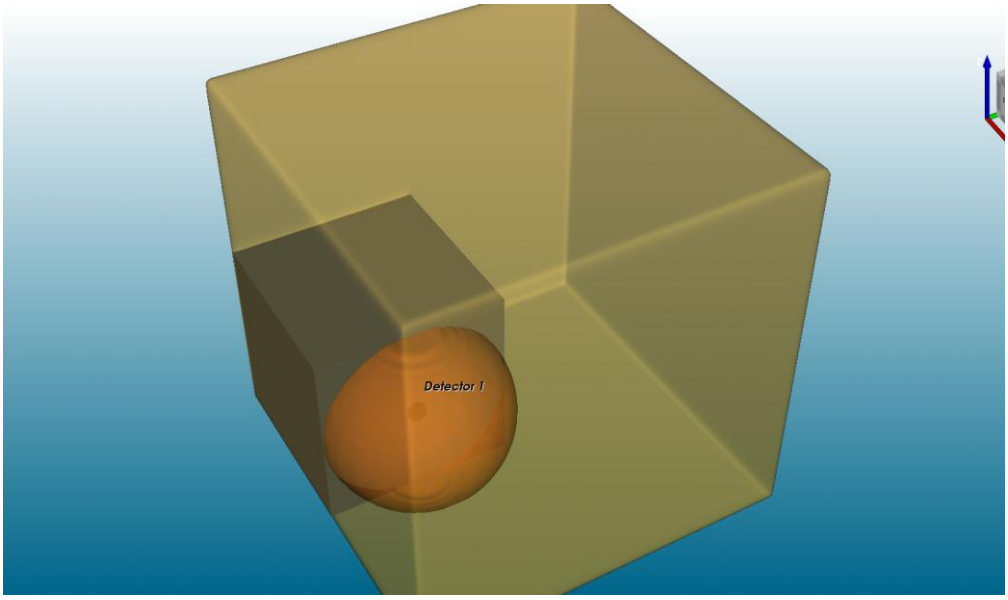
View 1 - L



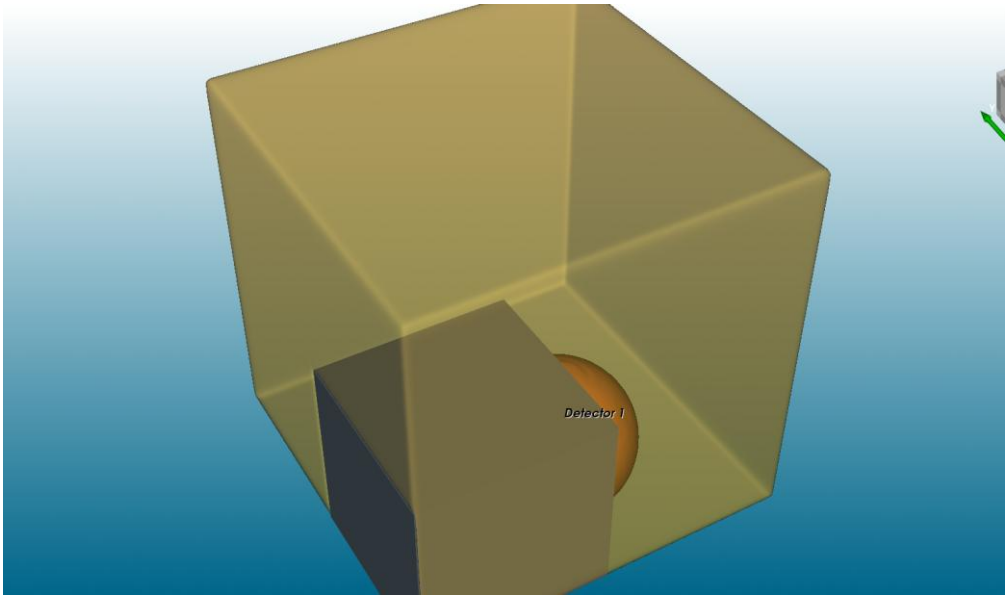
View 2 - L



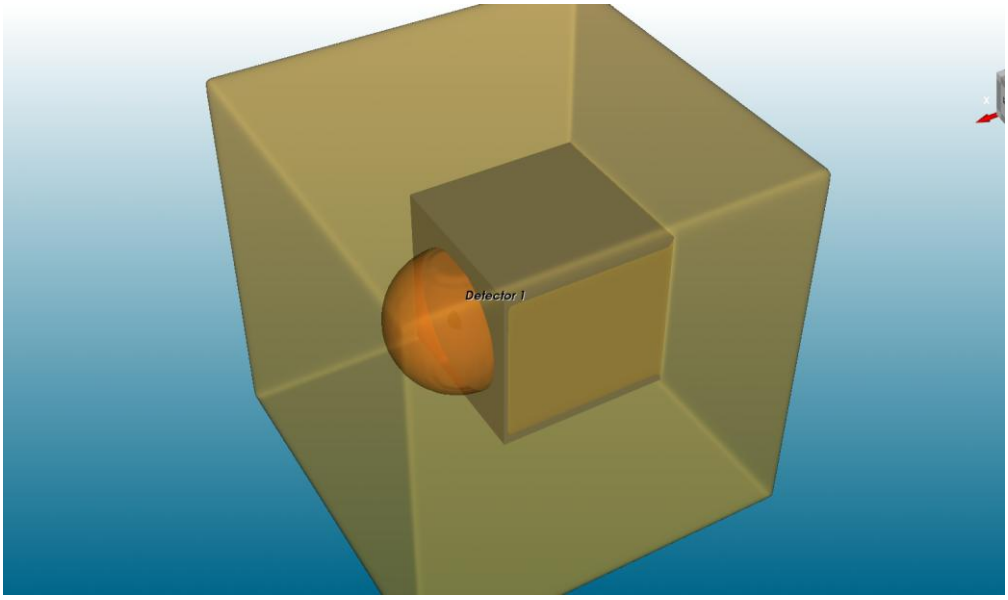
View 3 - L



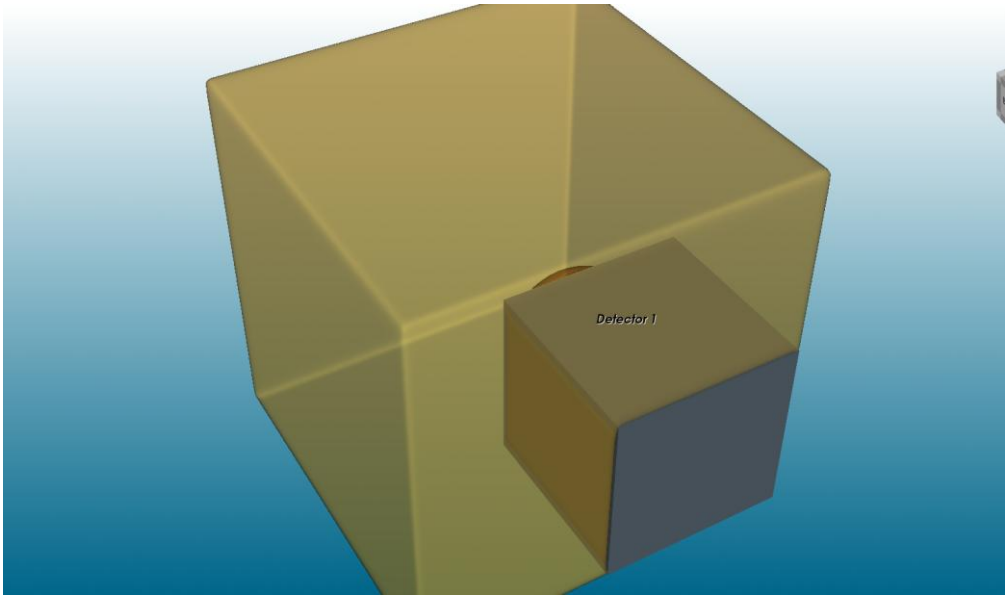
View 4 - L



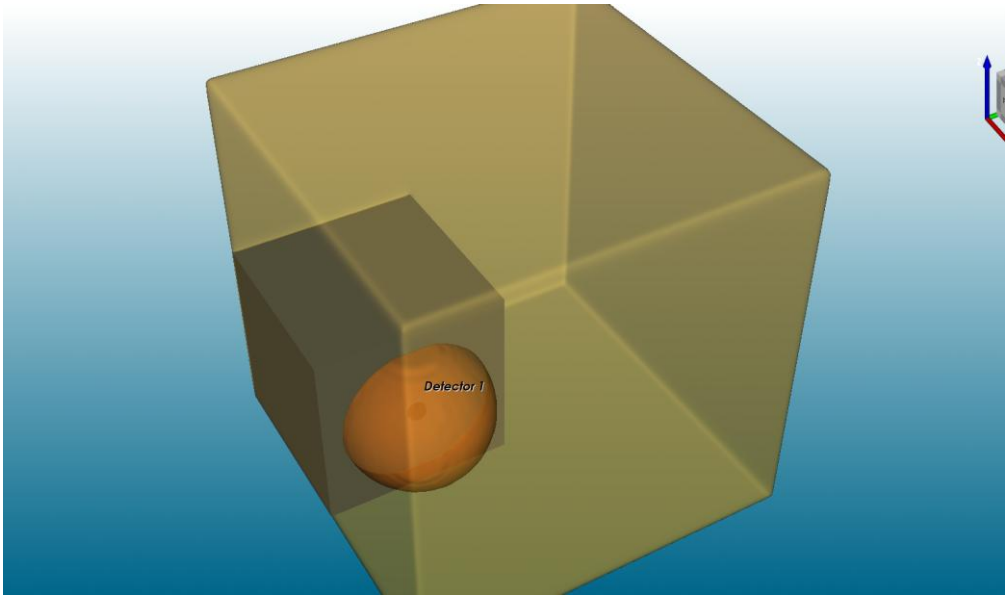
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.3 One PGD with its FOI completely inside a cylindrical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

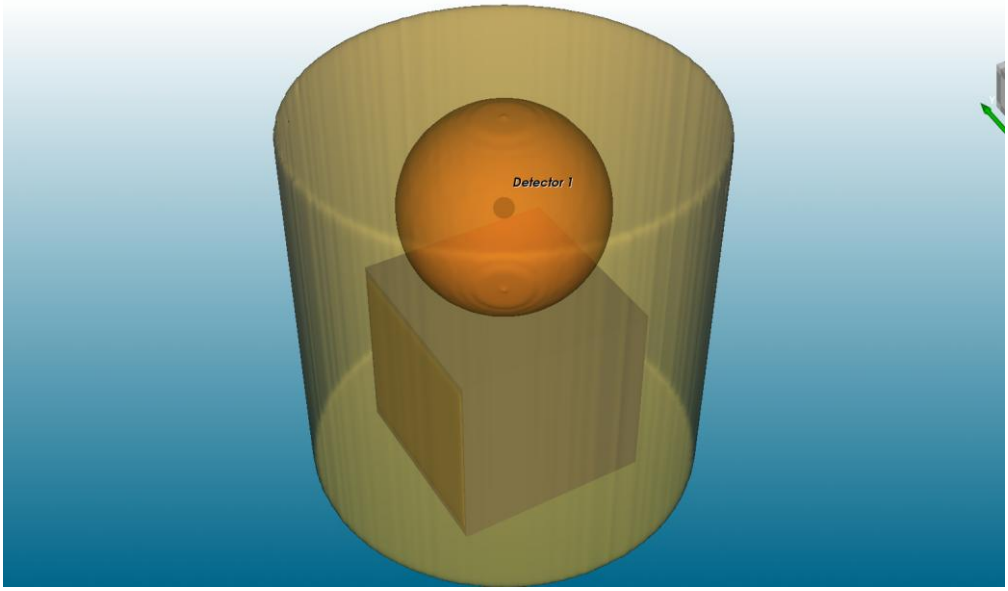
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade A

Gas Detectors

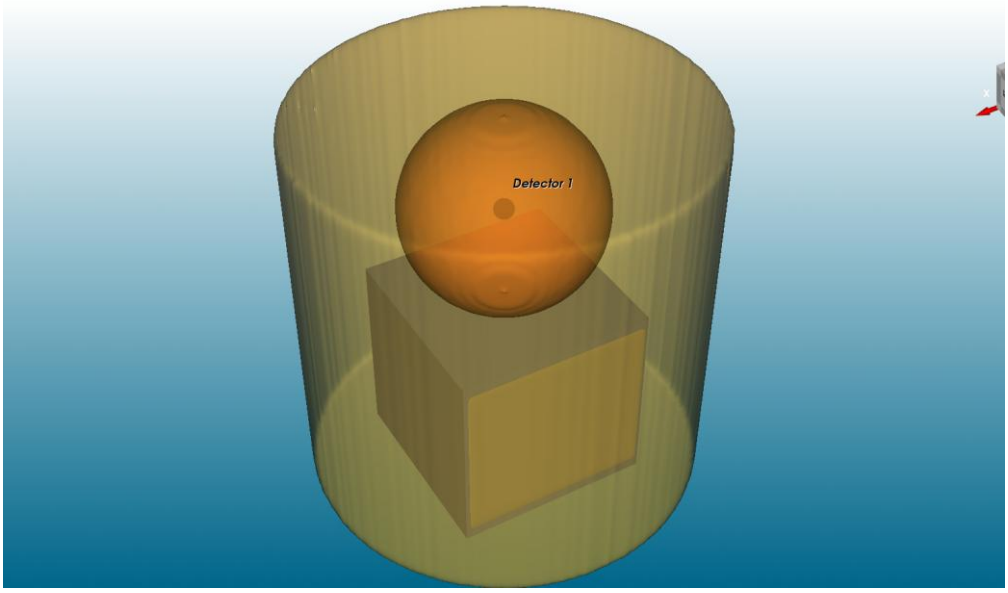
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 8 m

Coverage Results

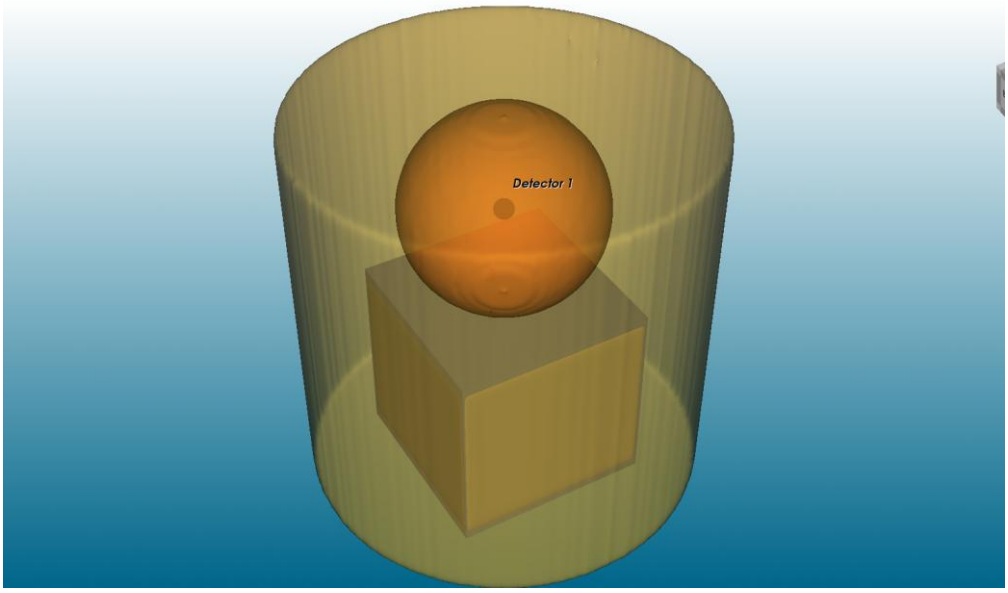
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	9.91	9.86	0.05
Grade A	1ooN	H	5.07	5.04	0.03



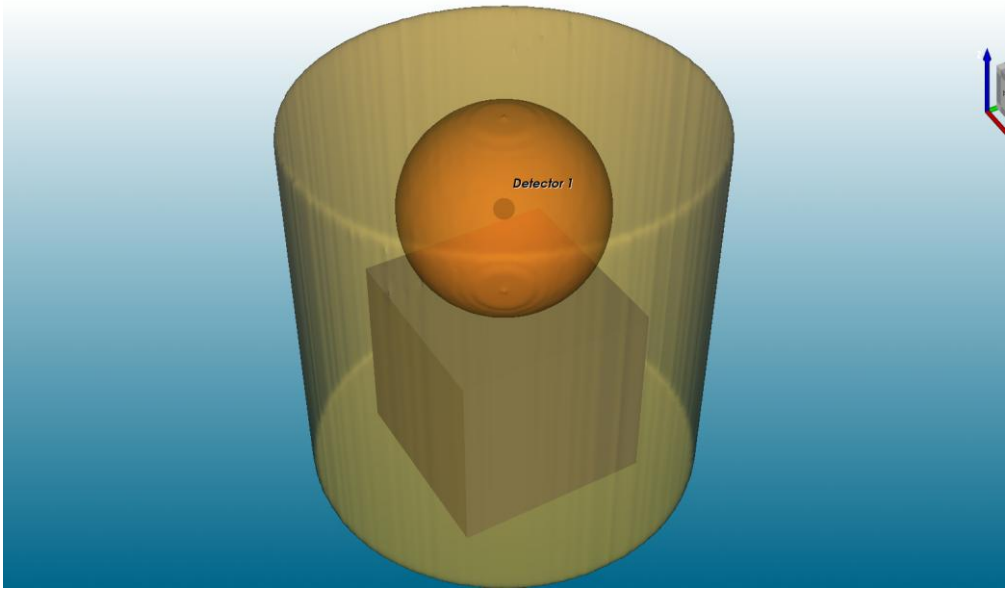
View 1 - L



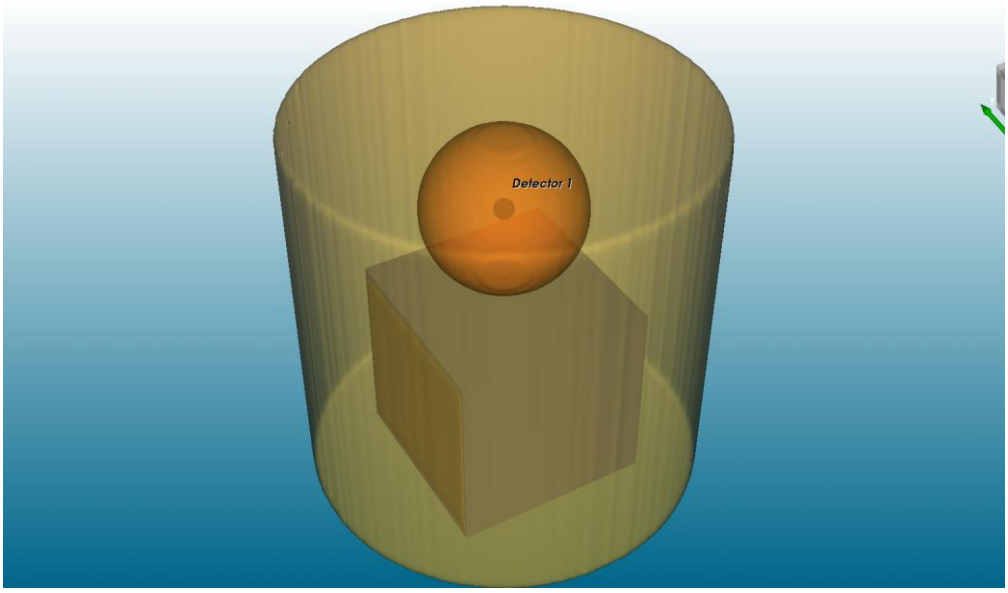
View 2 - L



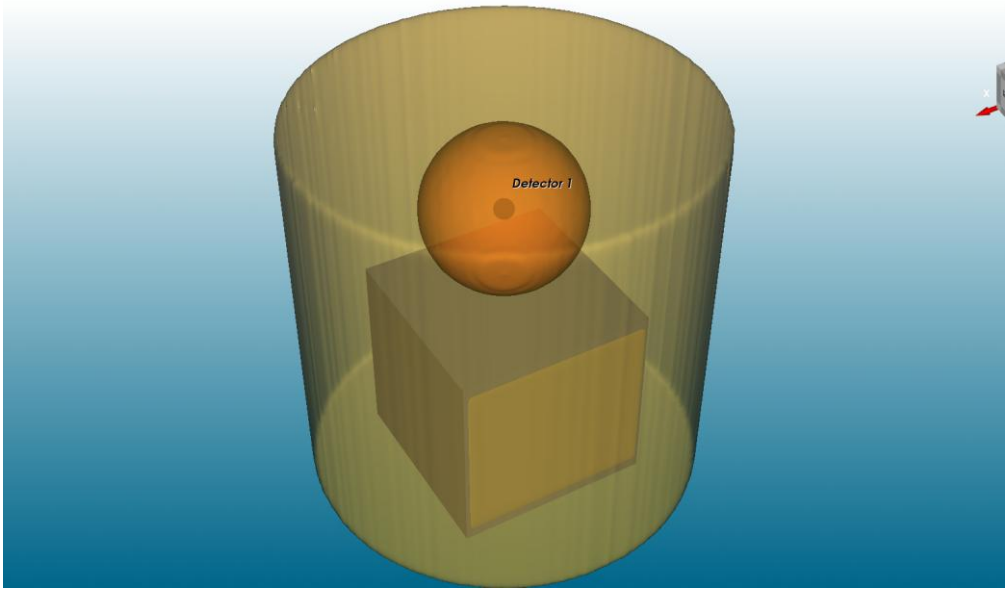
View 3 - L



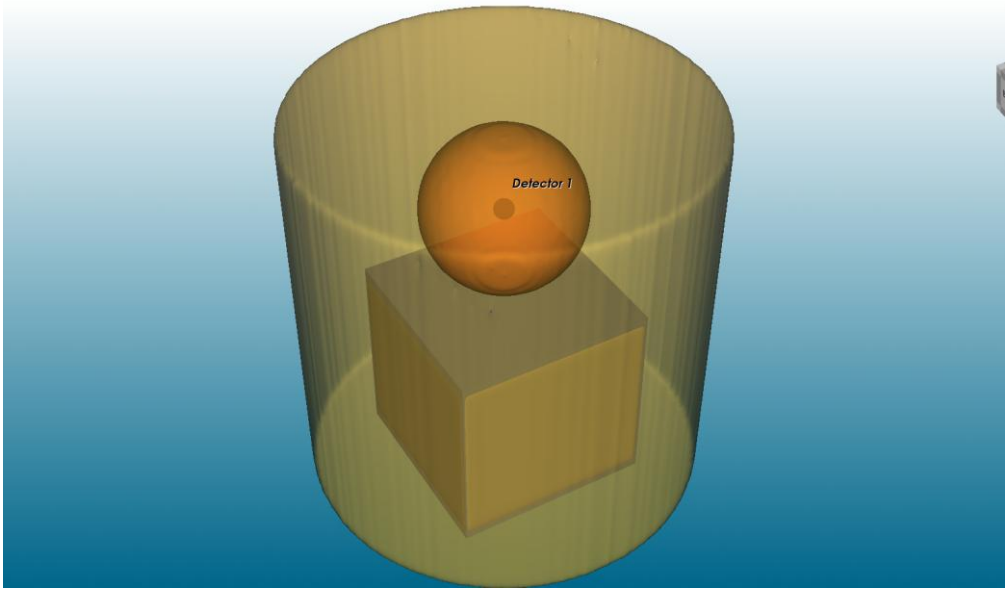
View 4 - L



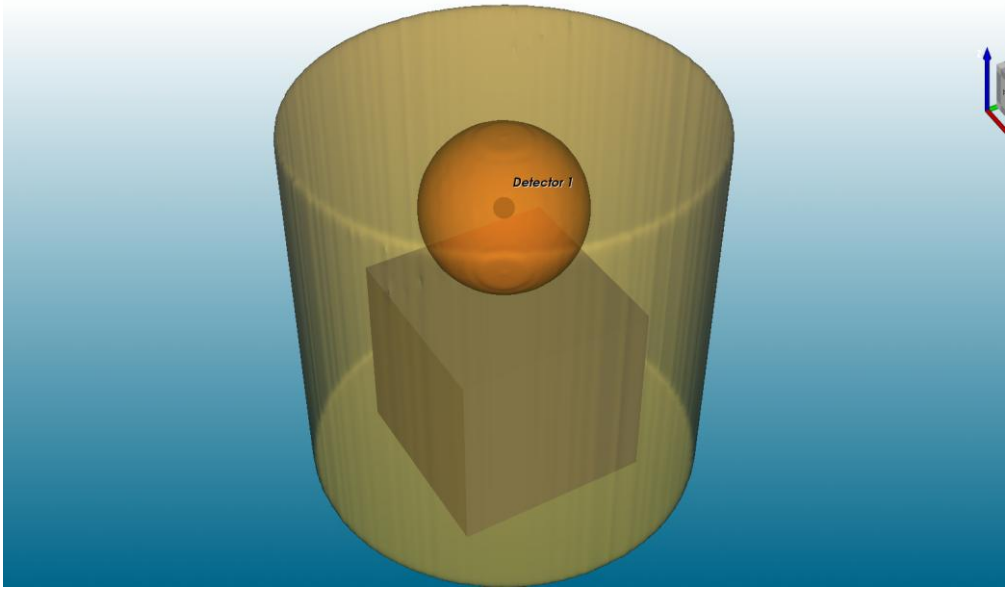
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.4 One Open Path Gas Detector (OPGD) with its Field of Influence (FOI) completely inside a cubical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

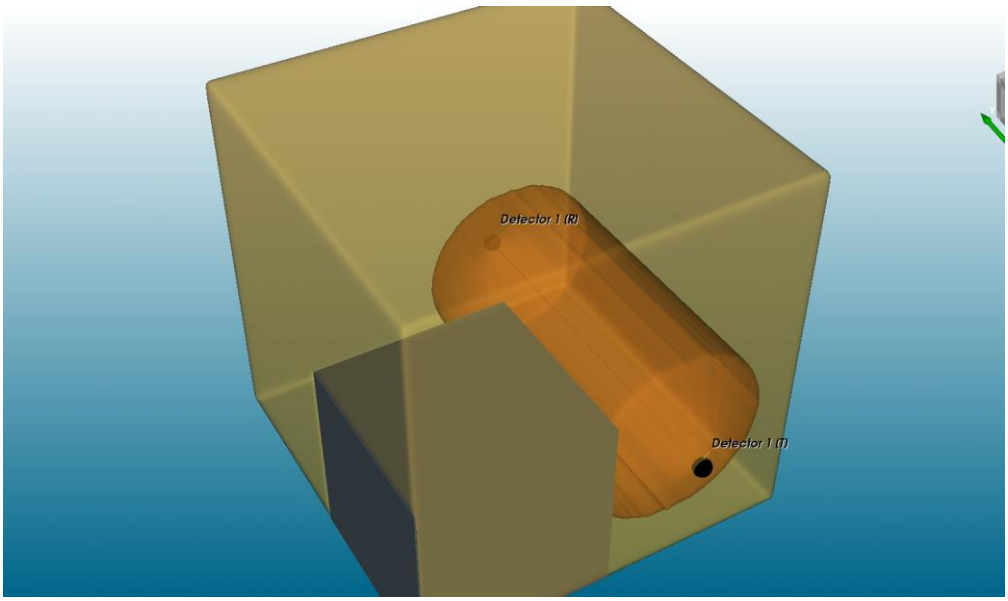
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

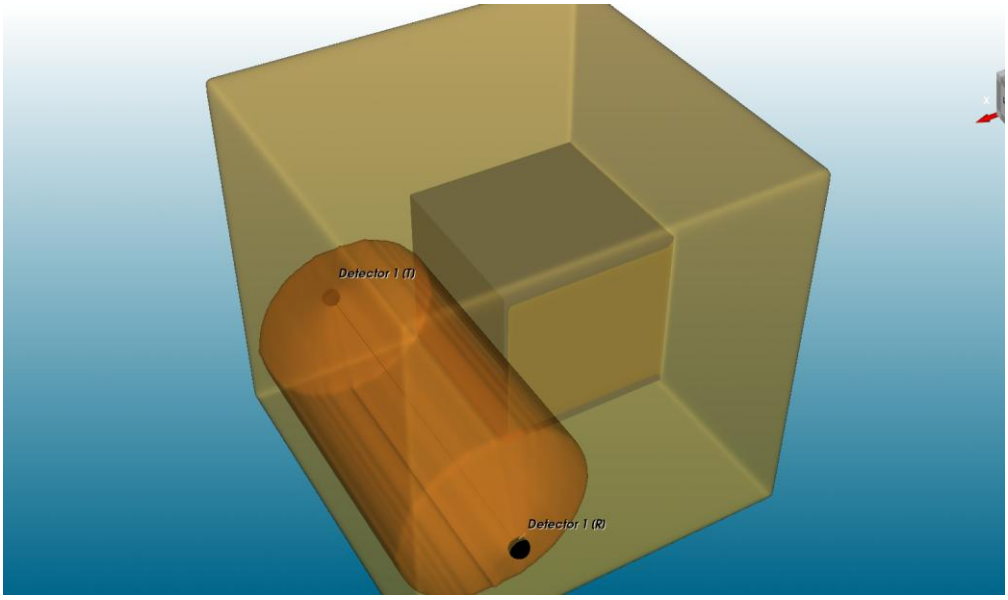
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - Low 10 m / High 5 m

Coverage Results

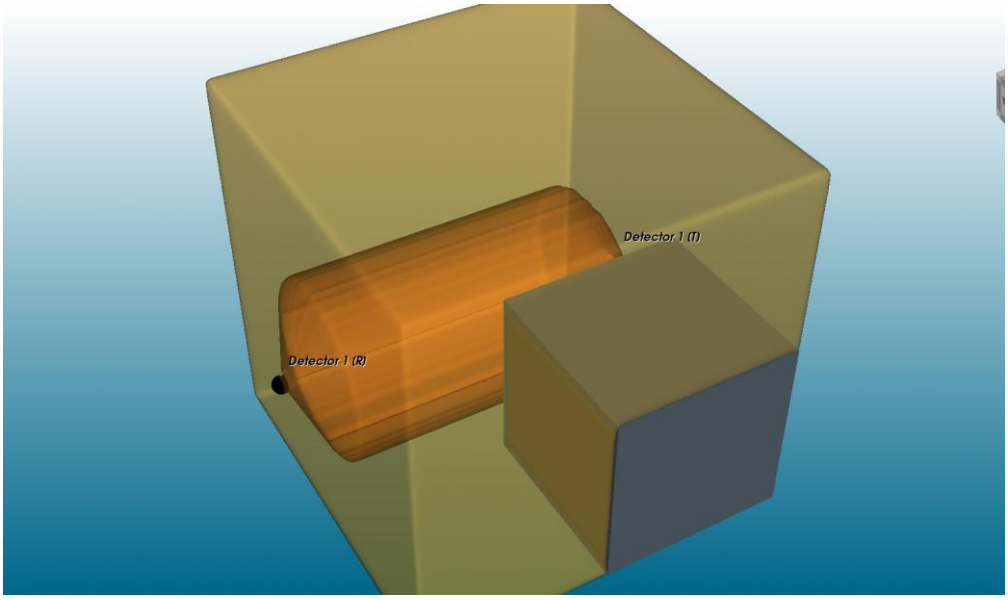
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	19.45	19.26	0.19
Grade A	1ooN	H	4.86	4.78	0.08



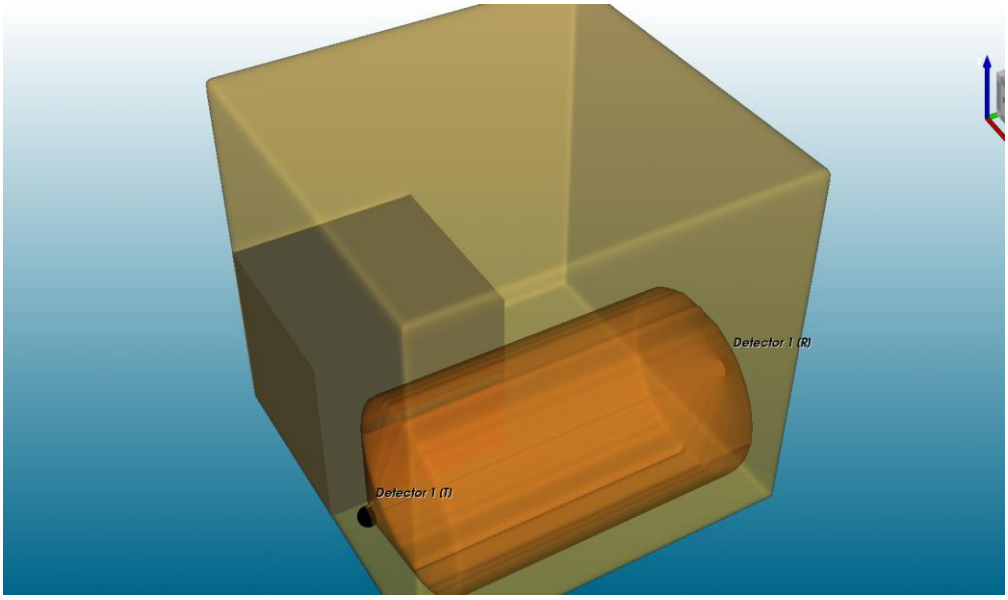
View 1 - L



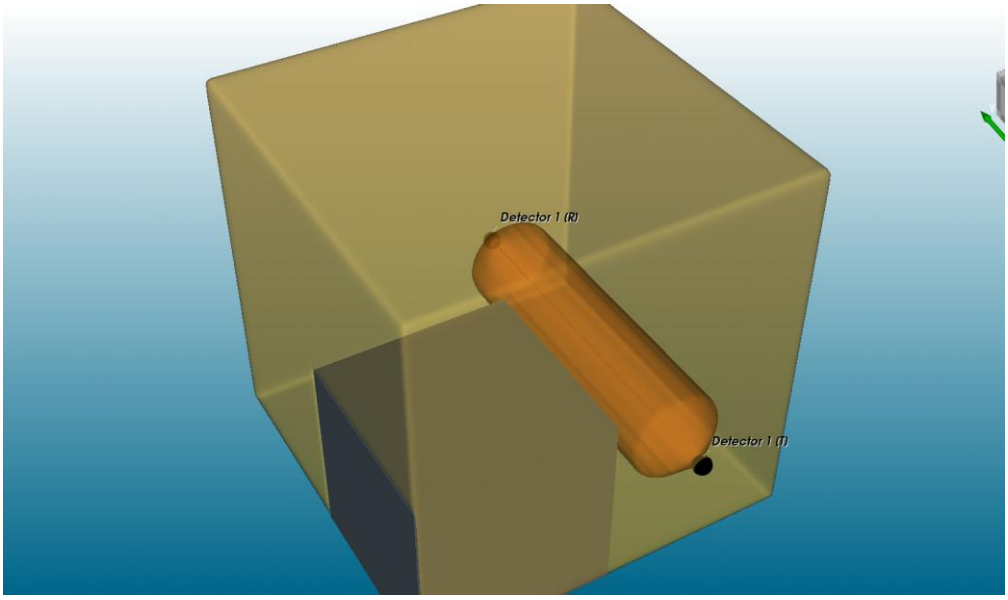
View 2 - L



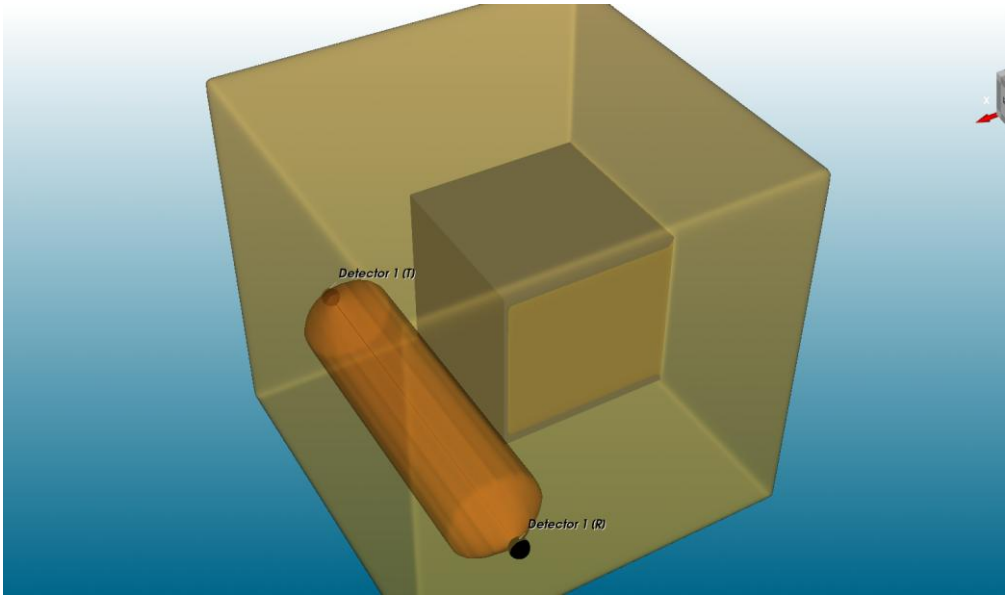
View 3 - L



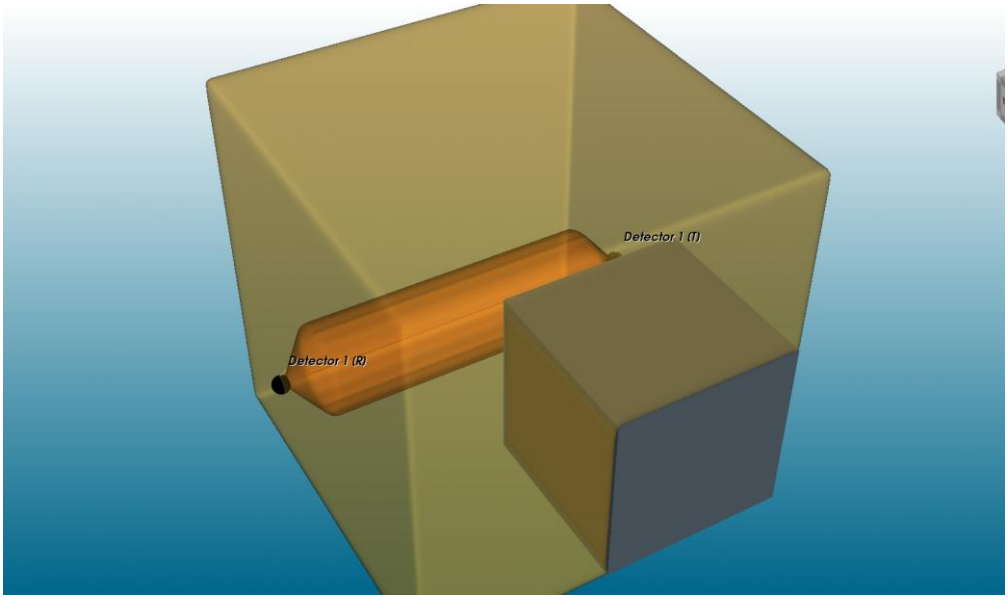
View 4 - L



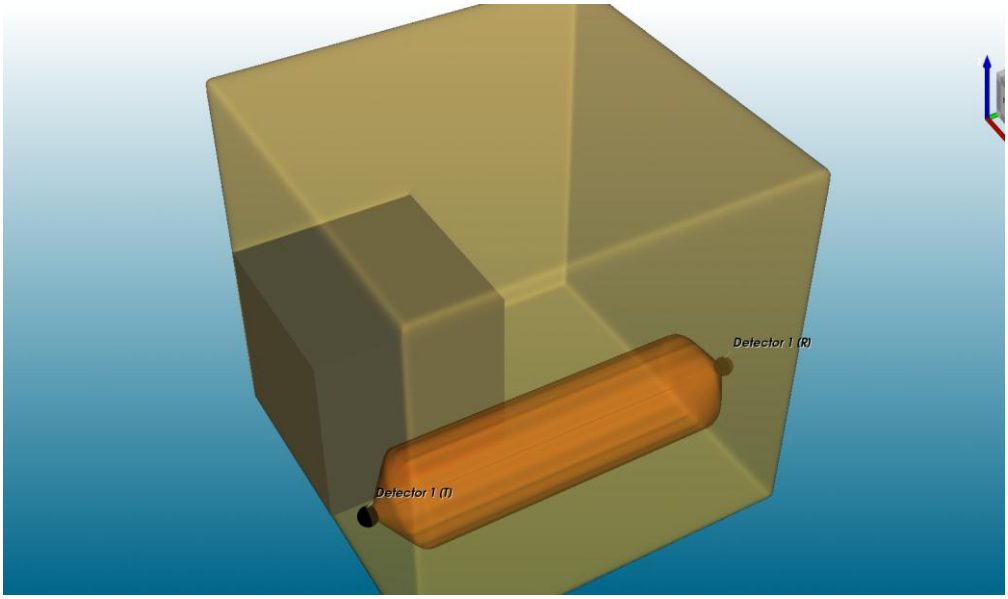
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.5 One OPGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

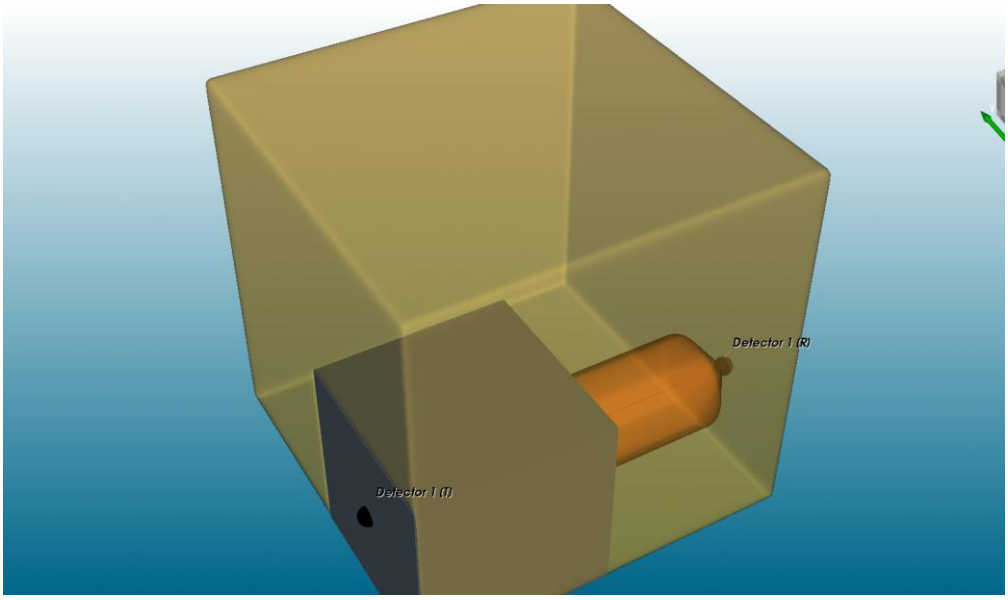
Gas Detectors

Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 5 m / High 5 m

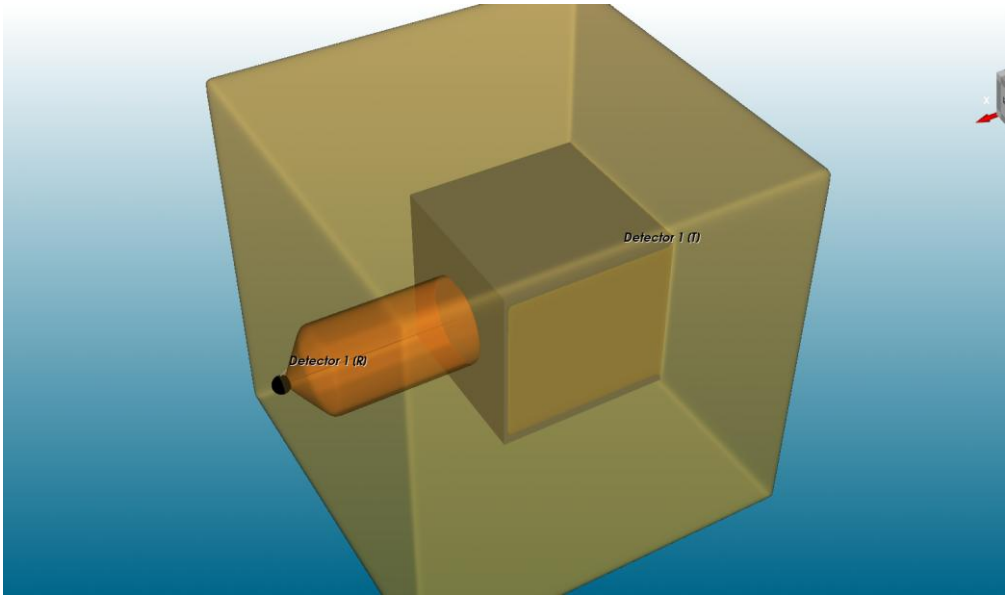
Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	2.43	2.41	0.02
Grade C	1ooN	H	2.43	2.41	0.02

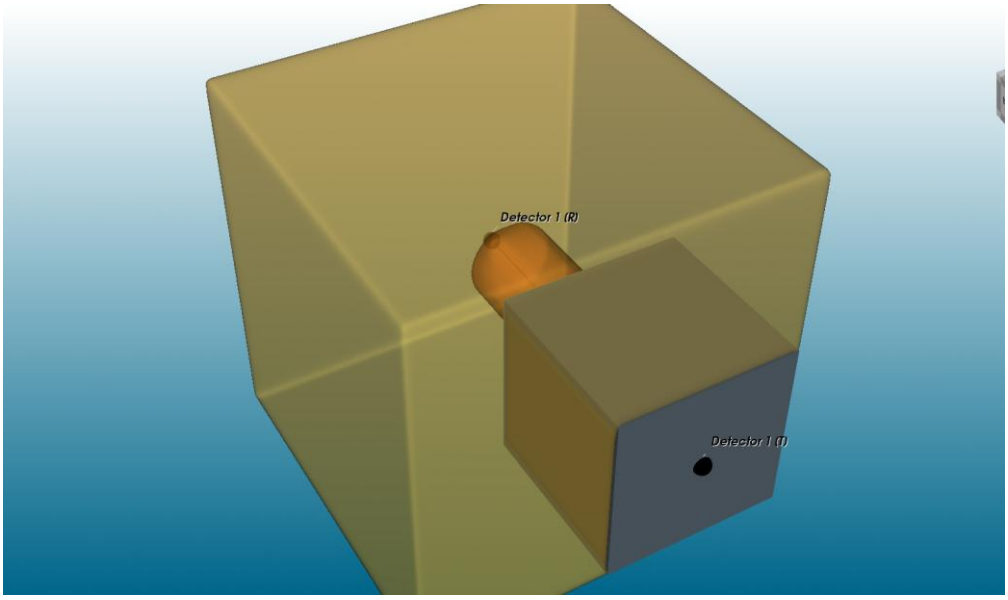
Note: 'Half inside' OPGD: line passes straight through the cube (y matches the cube's own y-centre) rather than sitting offset on its face — that's how the reference project did it for a line, vs the point case which sits centred exactly on the face.



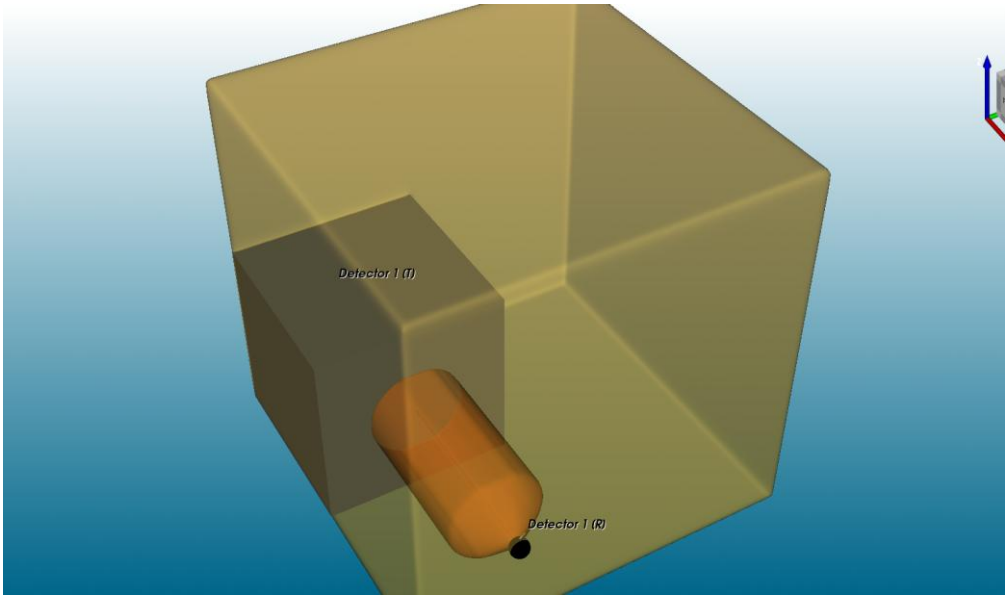
View 1 - L



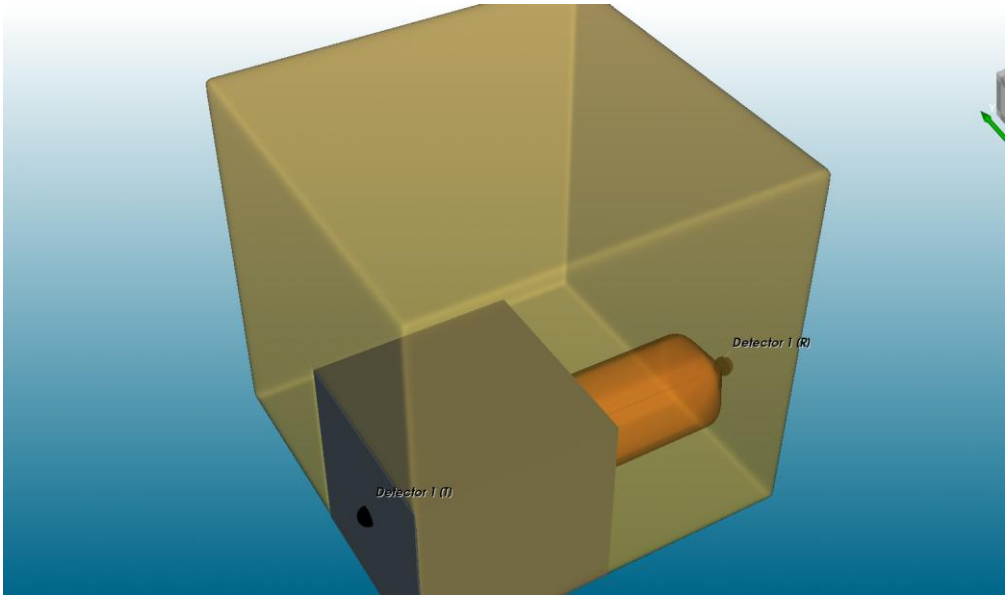
View 2 - L



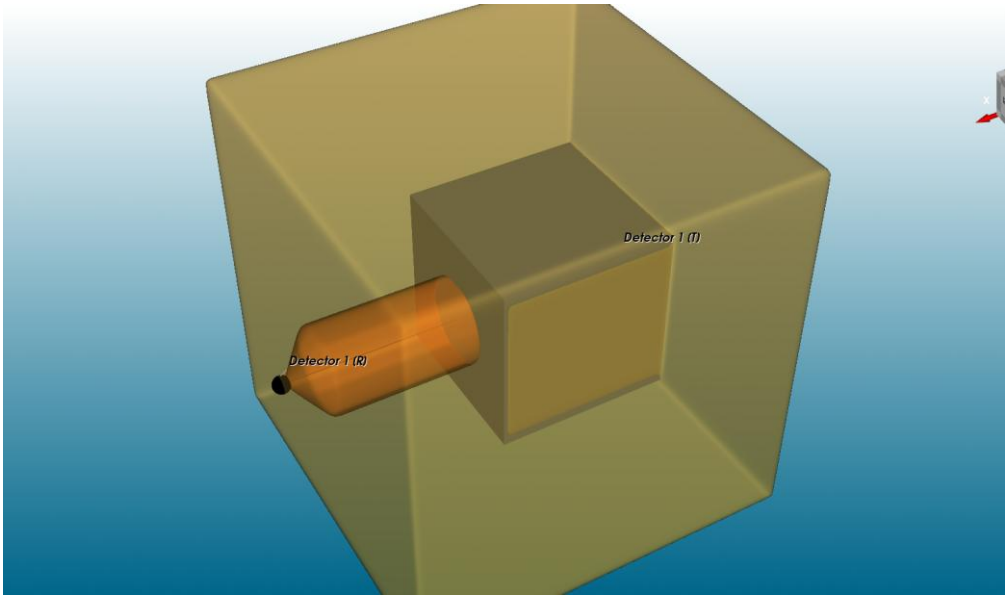
View 3 - L



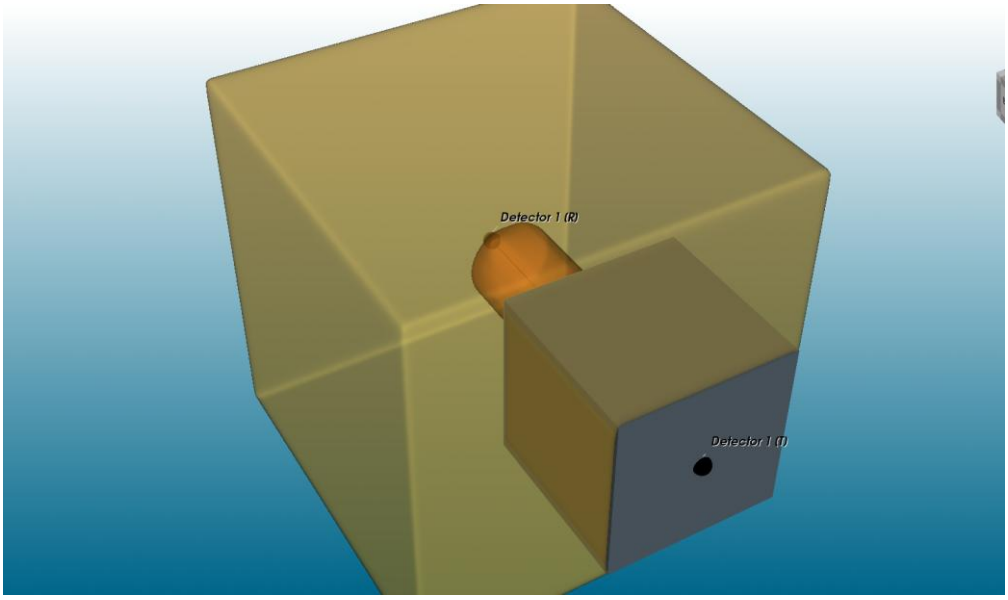
View 4 - L



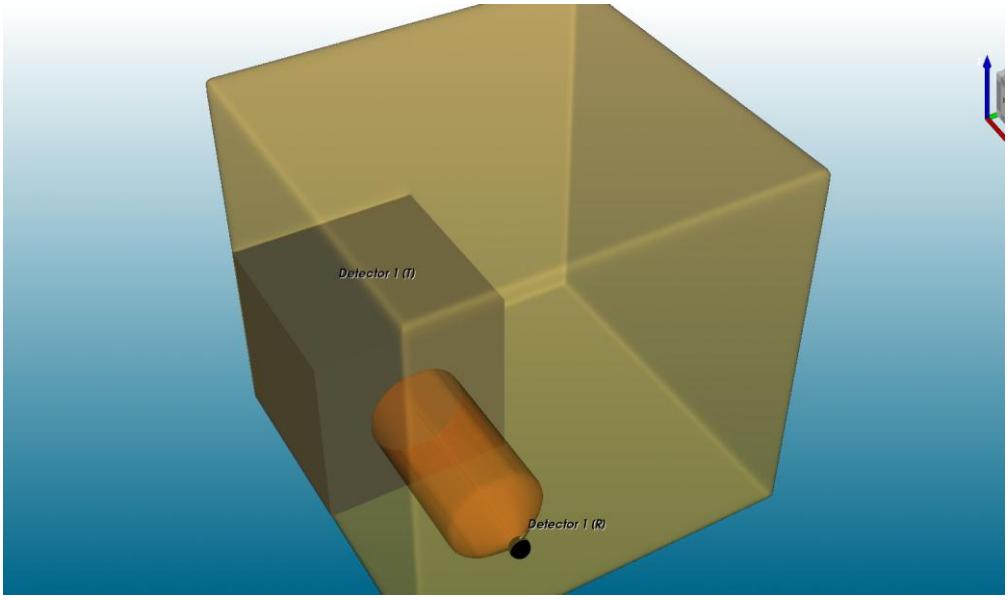
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.6 One OPGD with its FOI completely inside a cylindrical grade but outside a cubical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

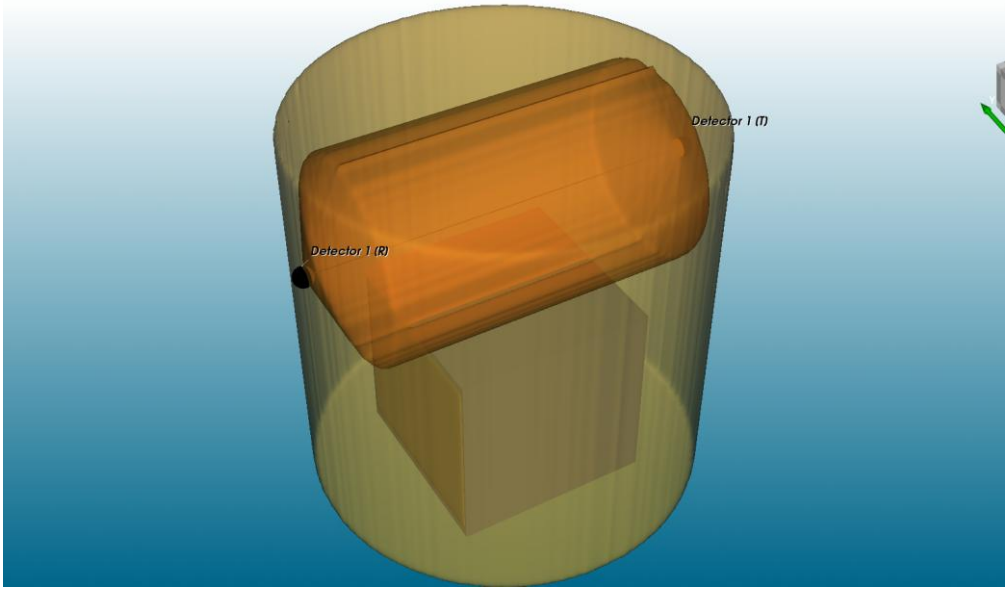
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade D

Gas Detectors

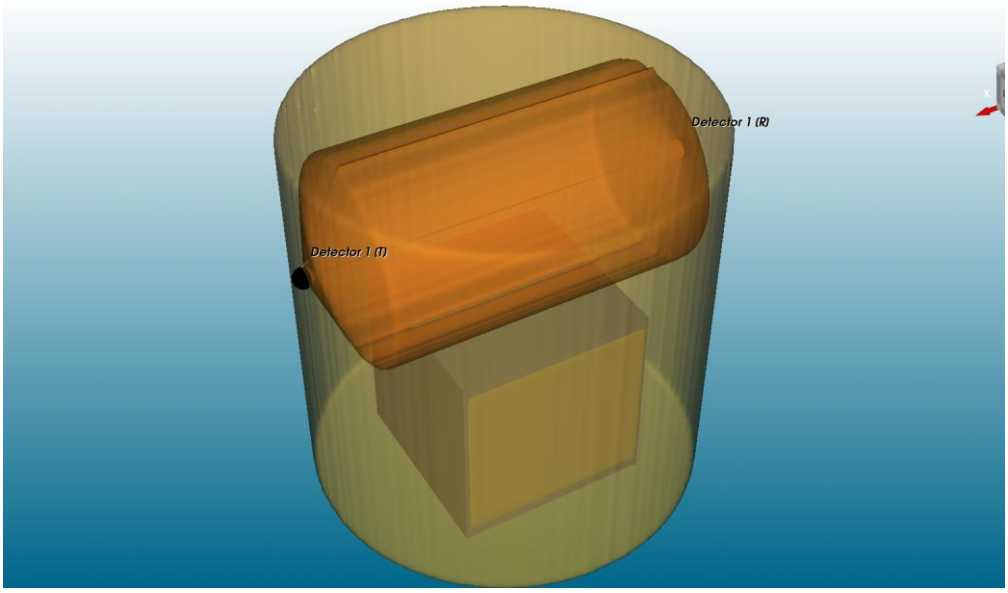
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - Low 10 m / High 5 m

Coverage Results

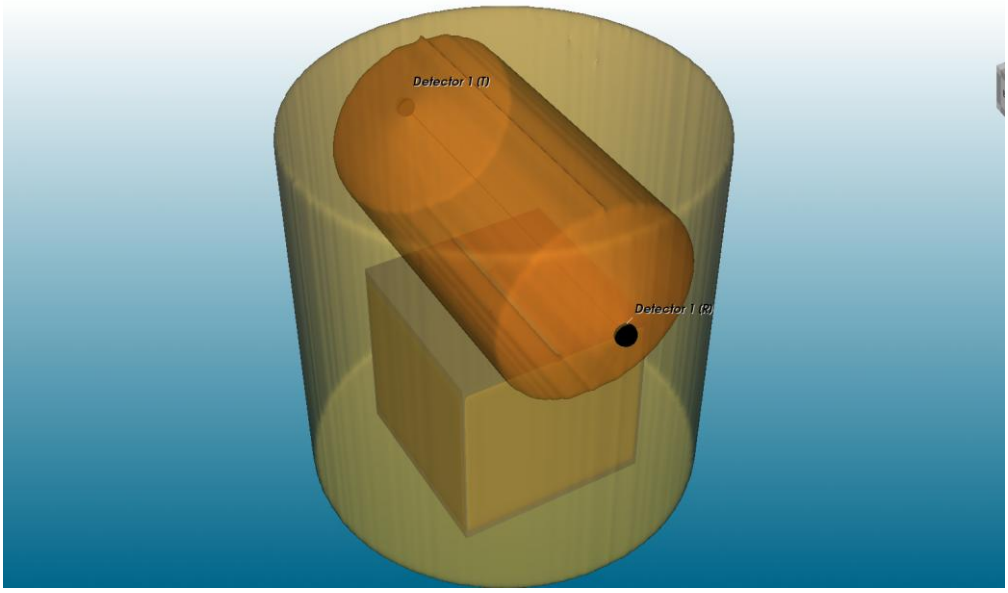
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	25.77	25.54	0.23
Grade D	1ooN	H	6.44	6.34	0.10



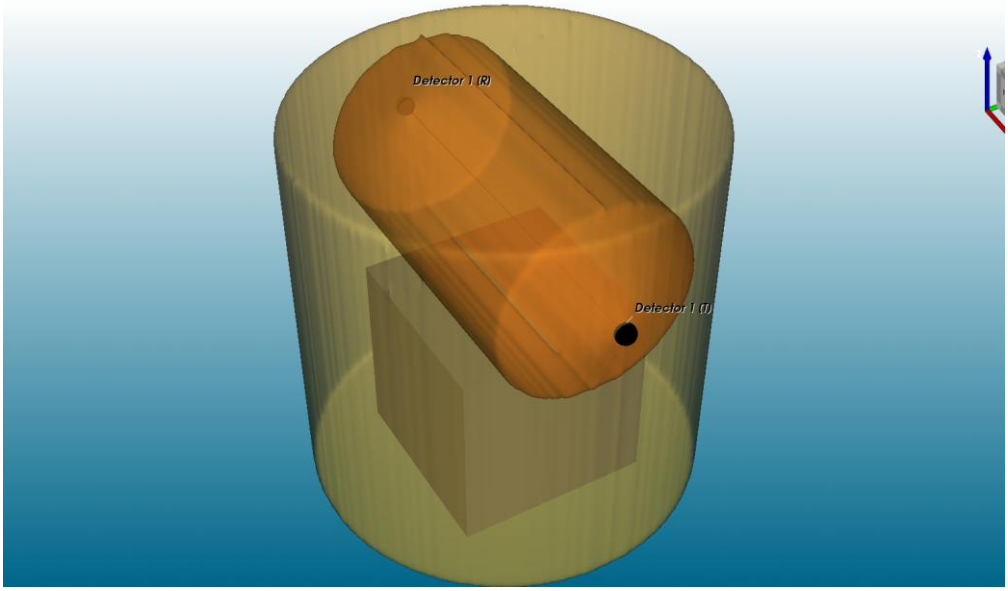
View 1 - L



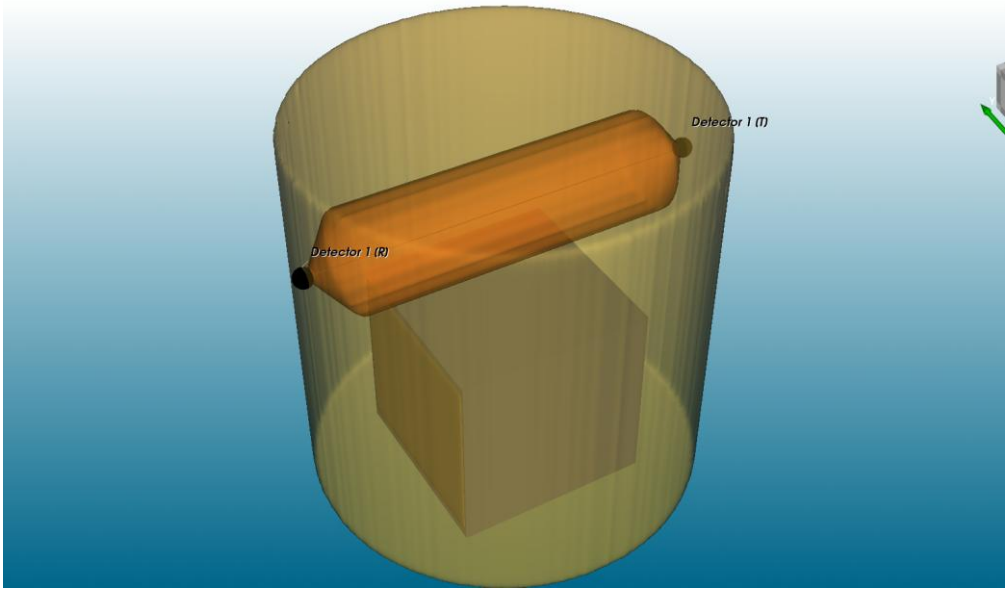
View 2 - L



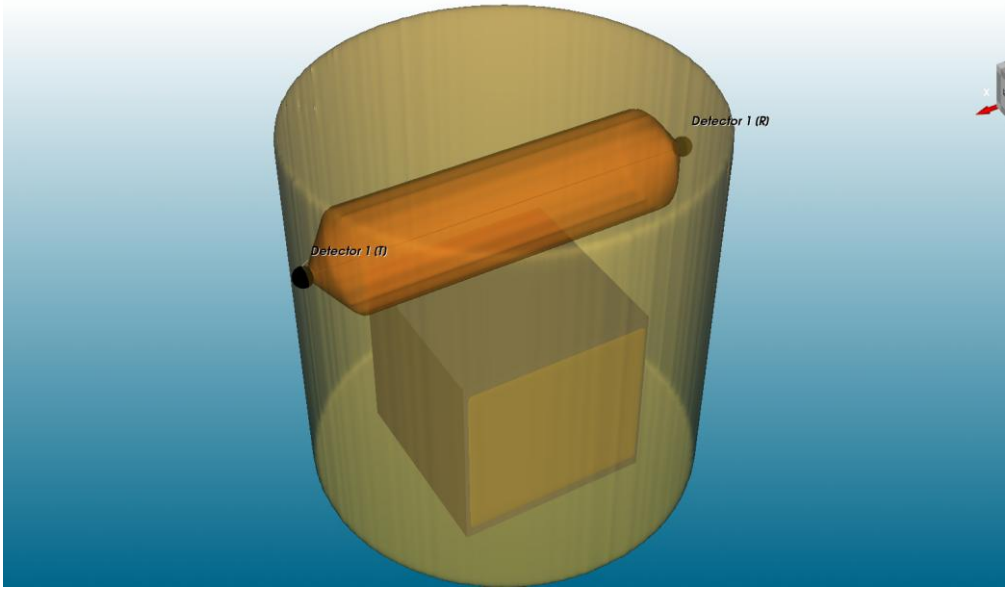
View 3 - L



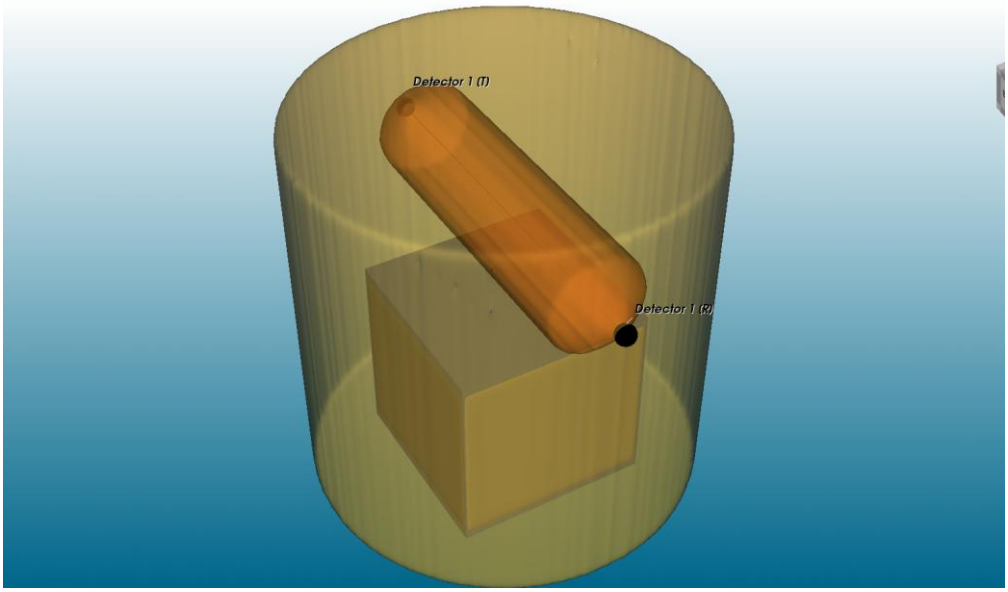
View 4 - L



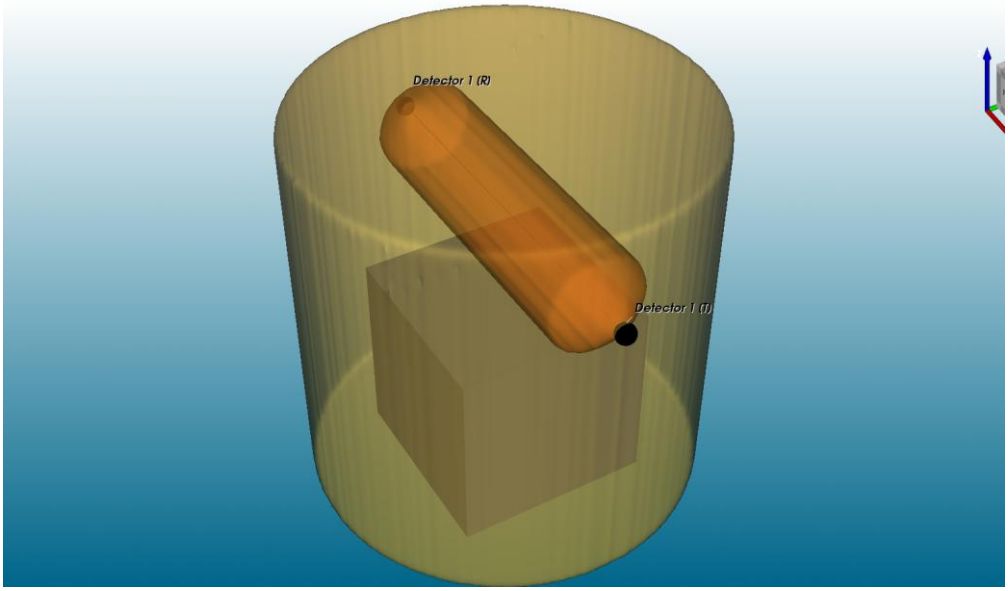
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.7 One PGD with its FOI completely inside a cubical grade but outside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

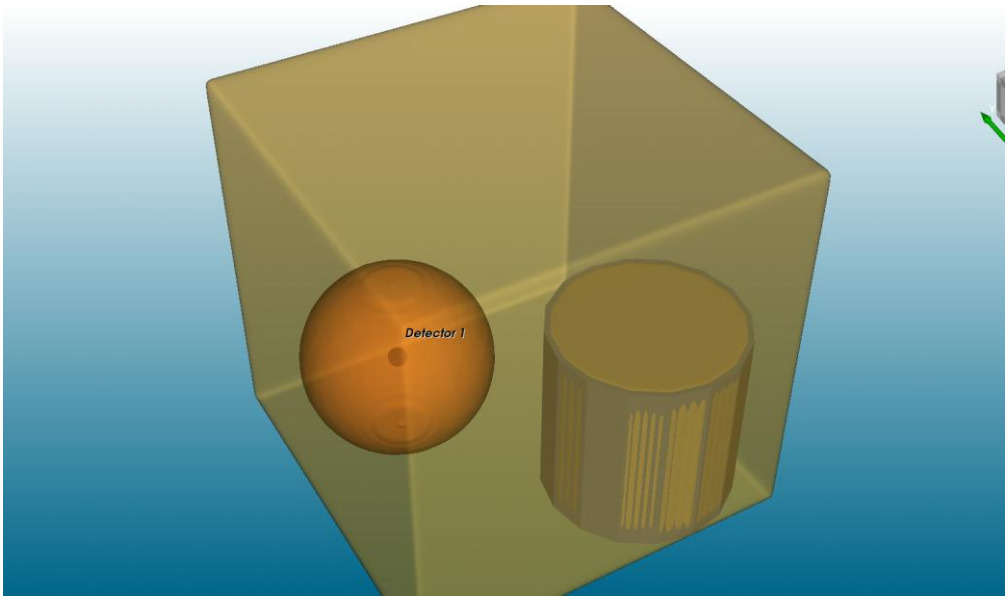
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

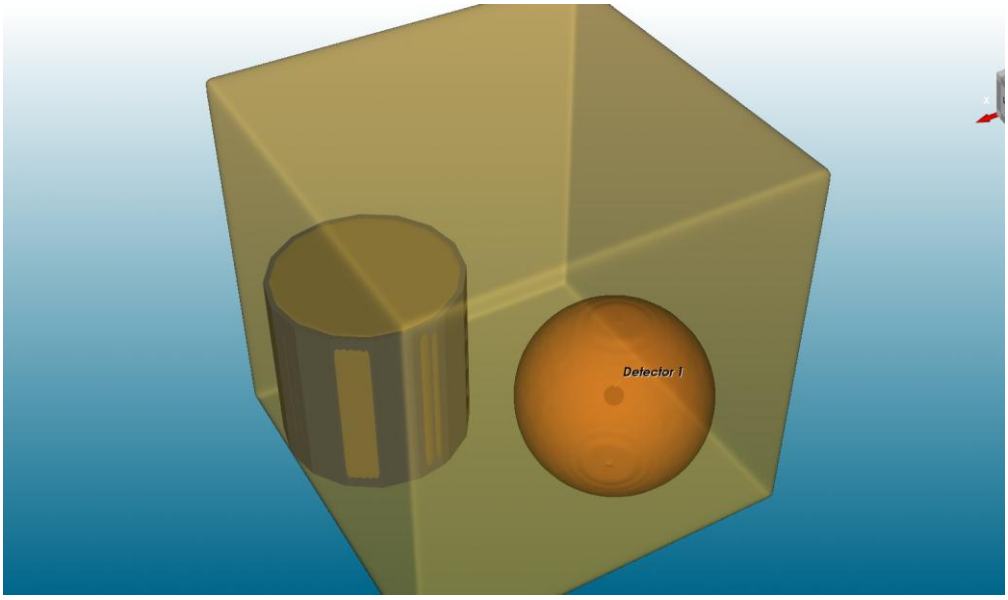
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 5 m

Coverage Results

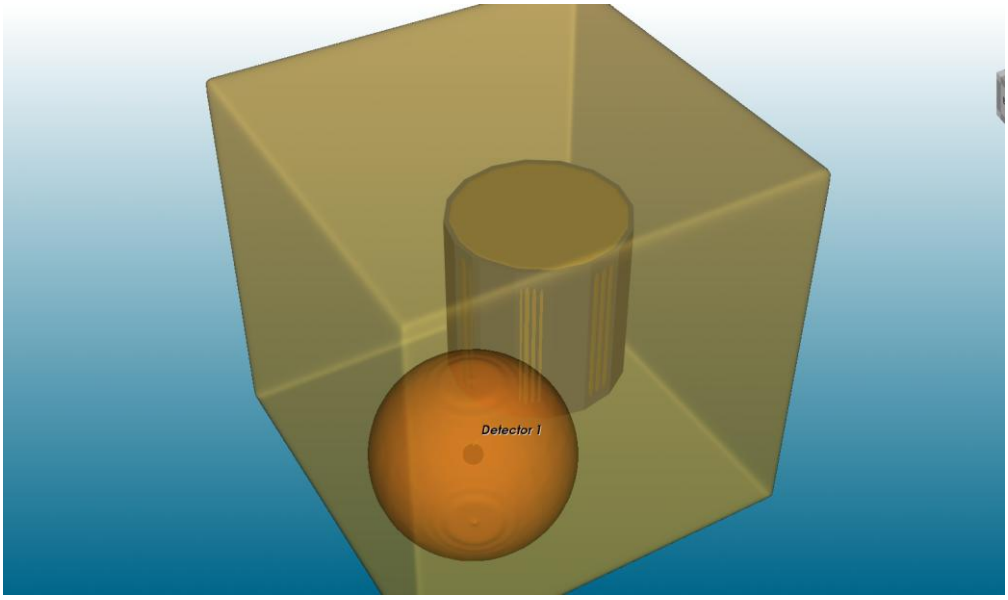
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	7.26	7.23	0.03
Grade A	1ooN	H	0.91	0.9	0.01



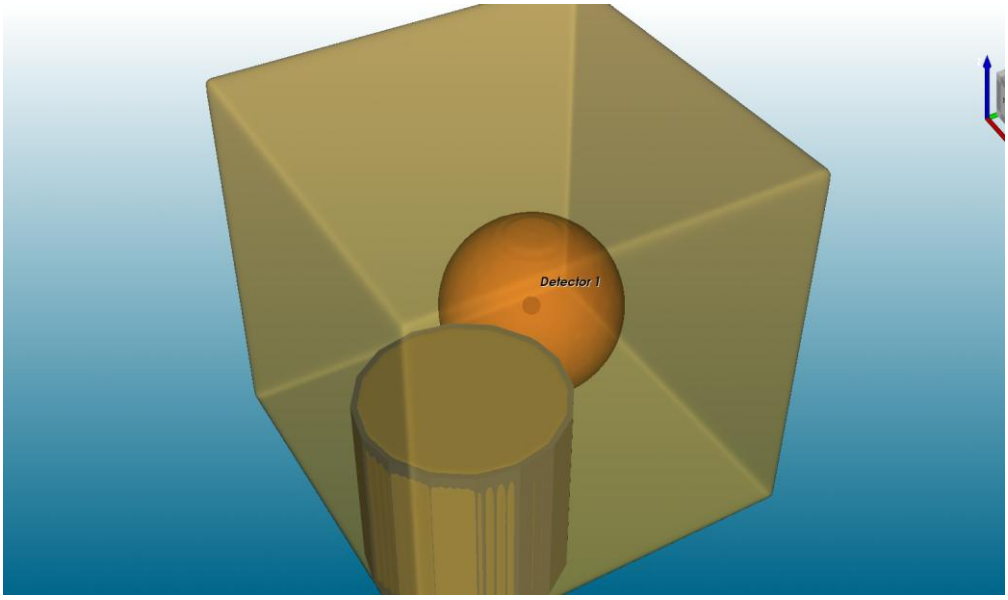
View 1 - L



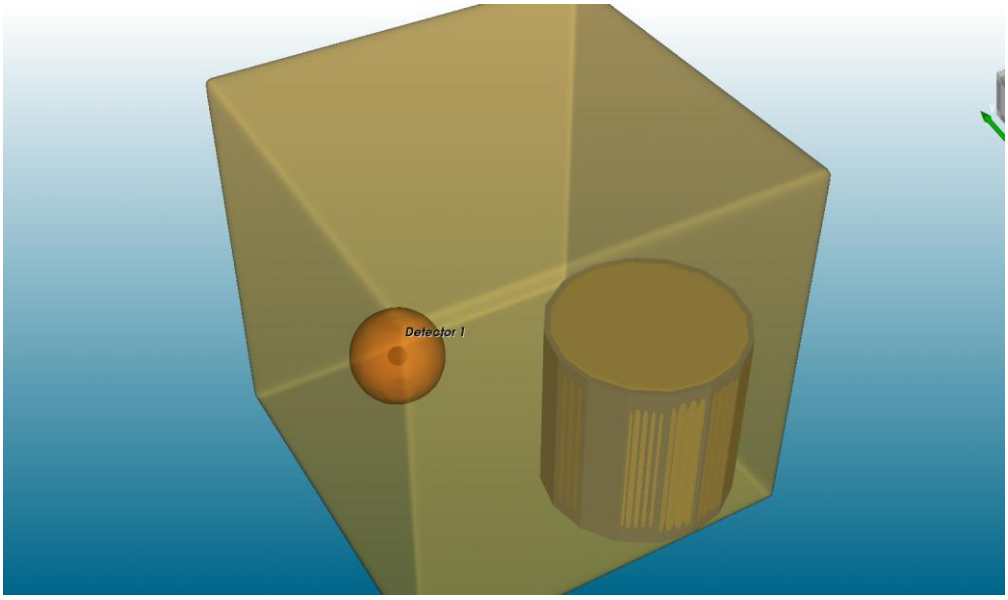
View 2 - L



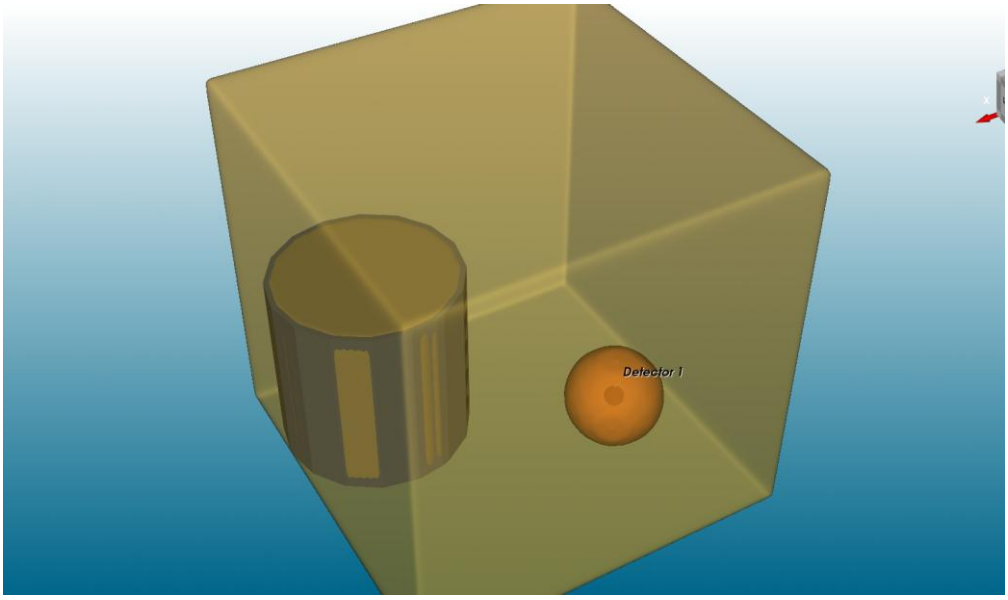
View 3 - L



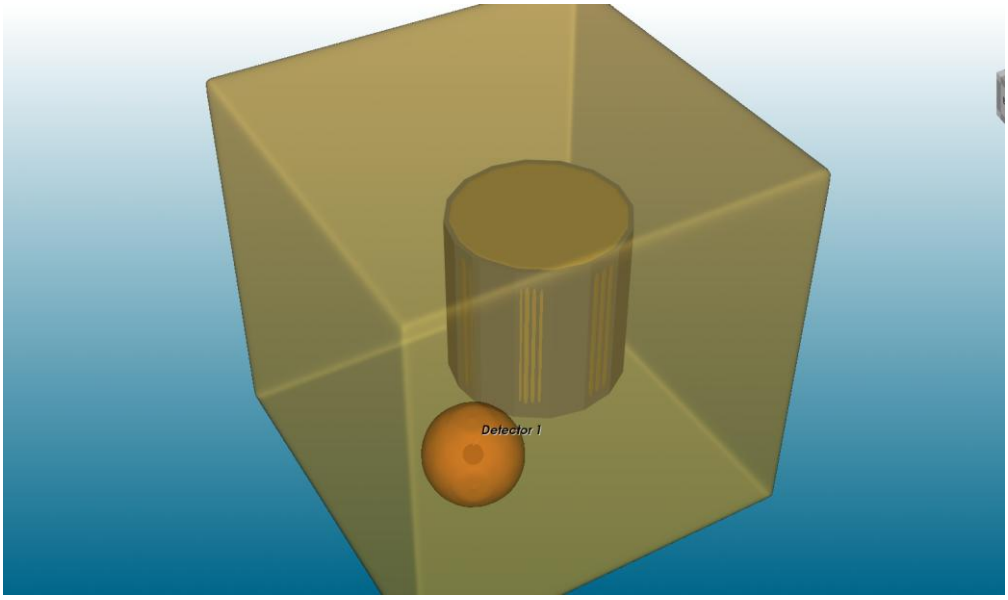
View 4 - L



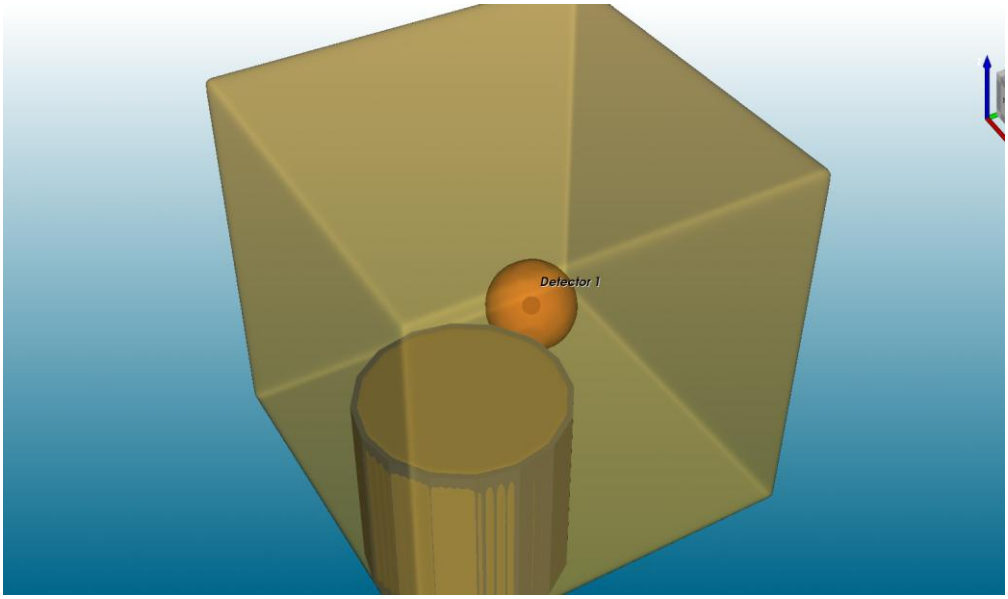
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.8 One PGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

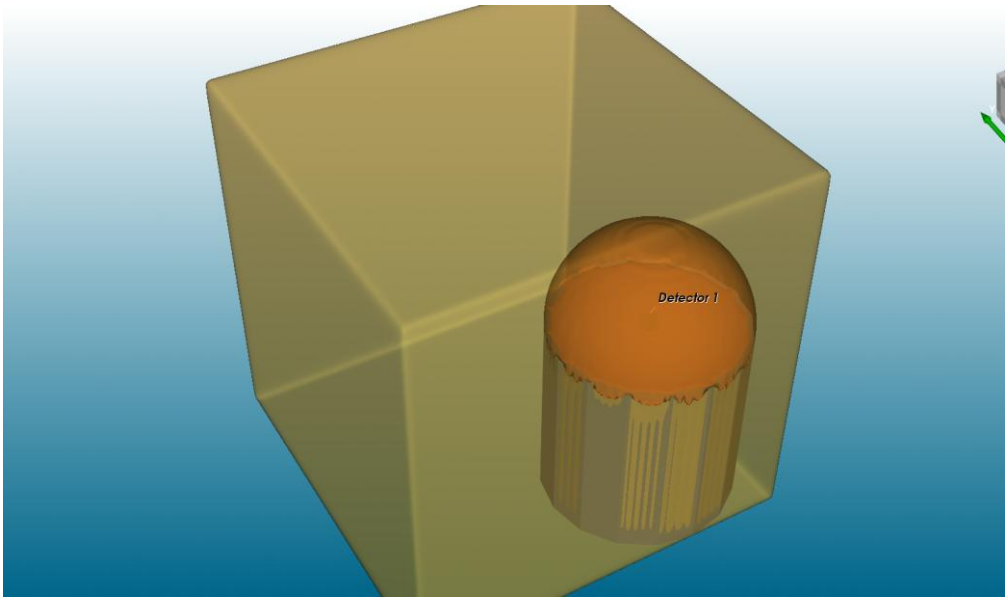
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

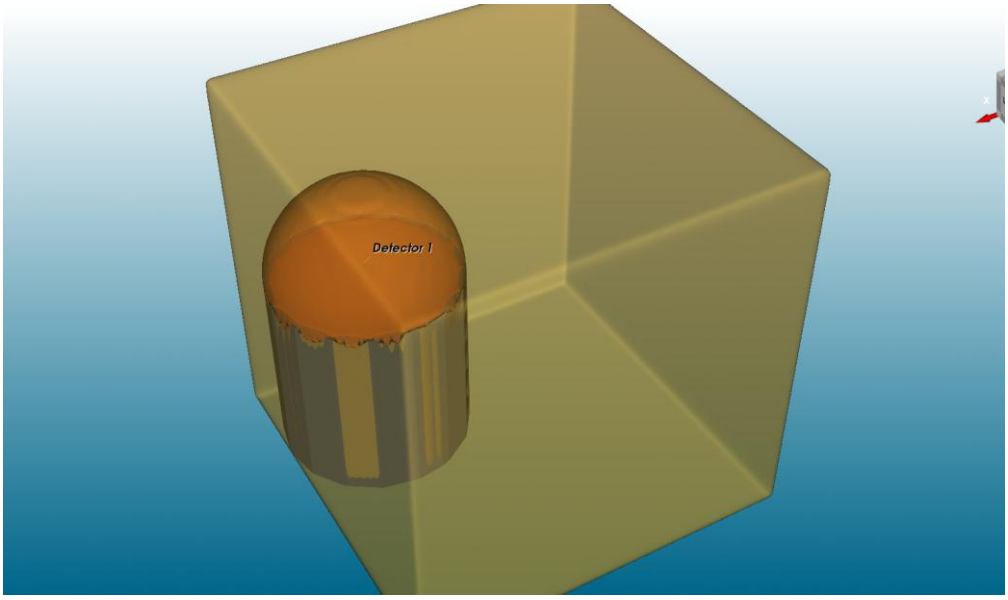
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - Low 10 m / High 10 m

Coverage Results

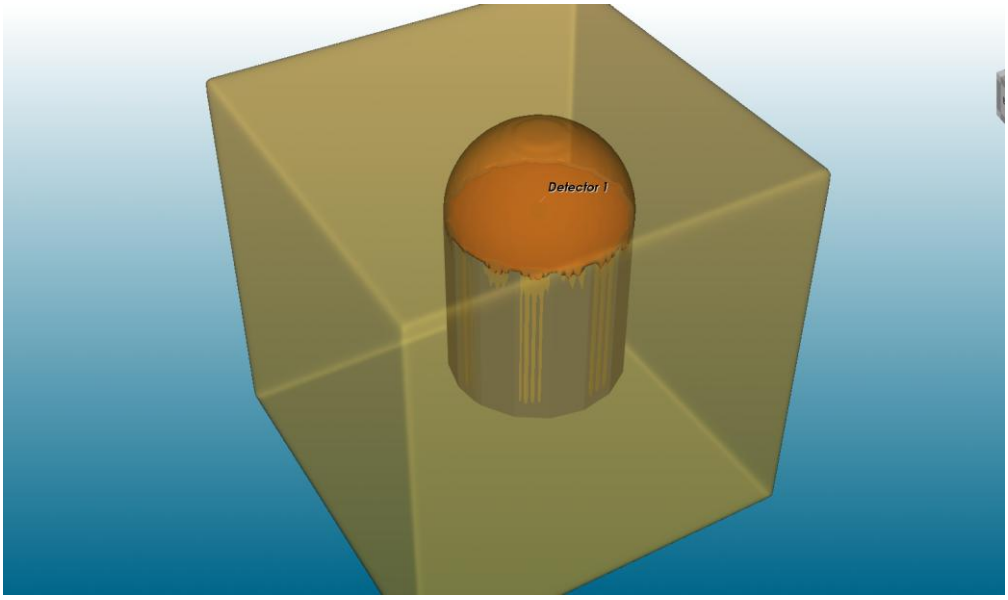
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	3.63	3.71	0.08
Grade D	1ooN	H	3.63	3.71	0.08



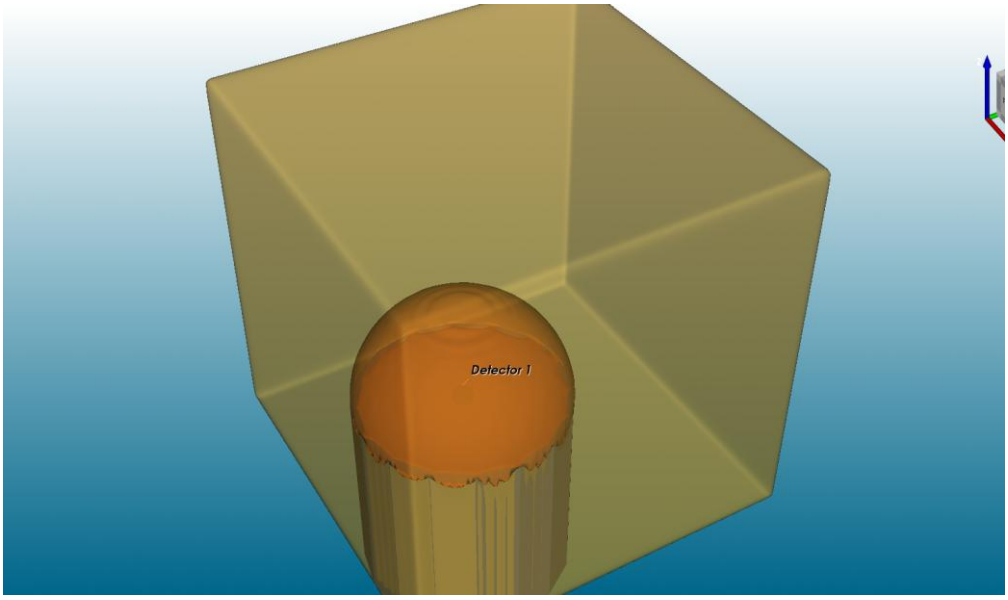
View 1 - L



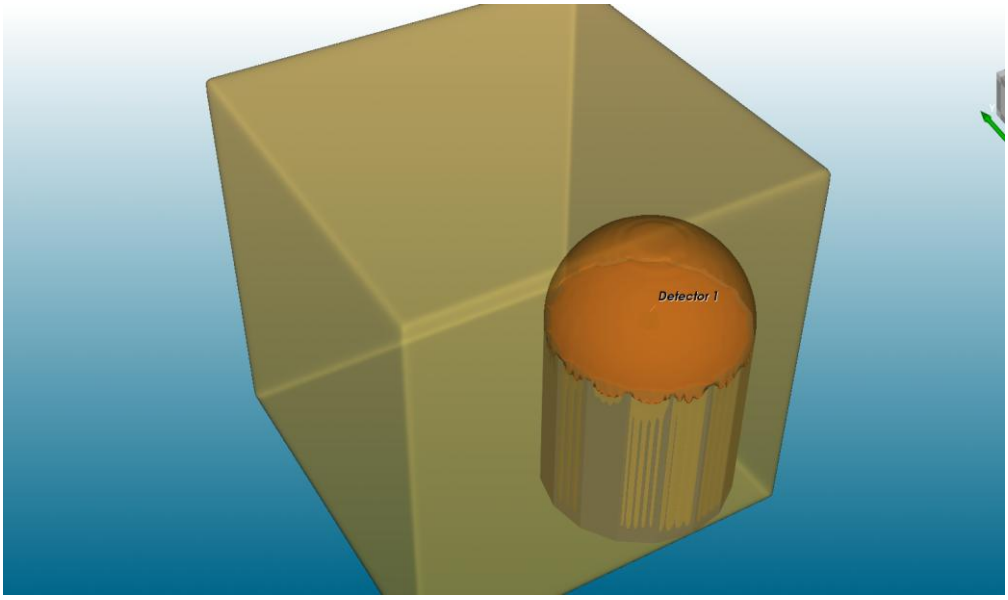
View 2 - L



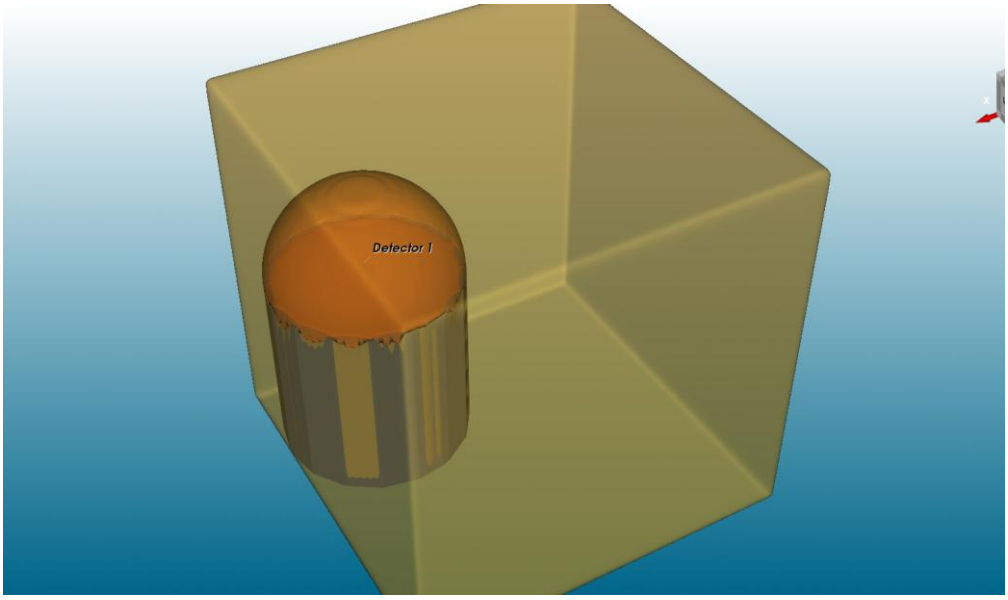
View 3 - L



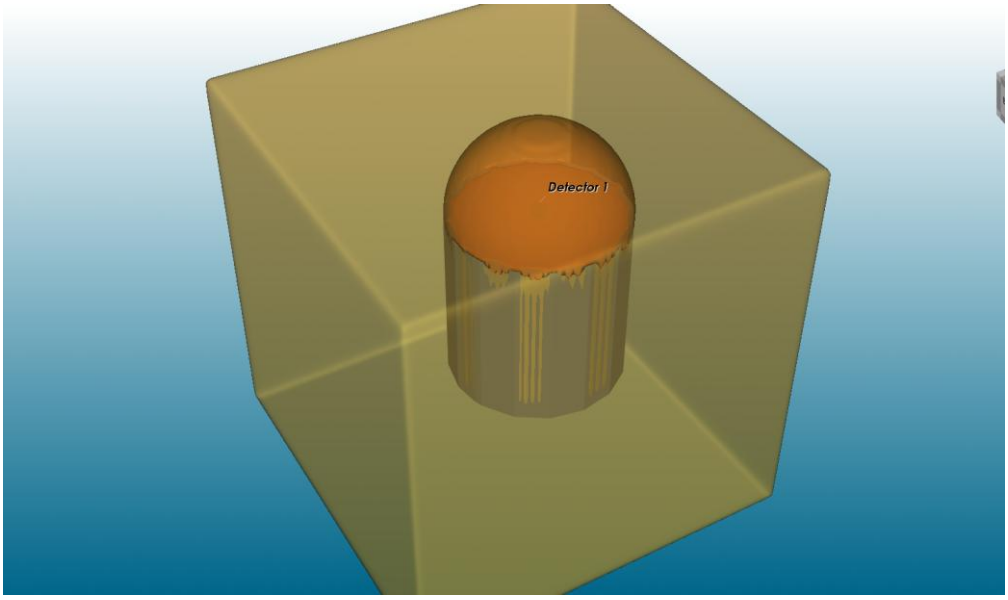
View 4 - L



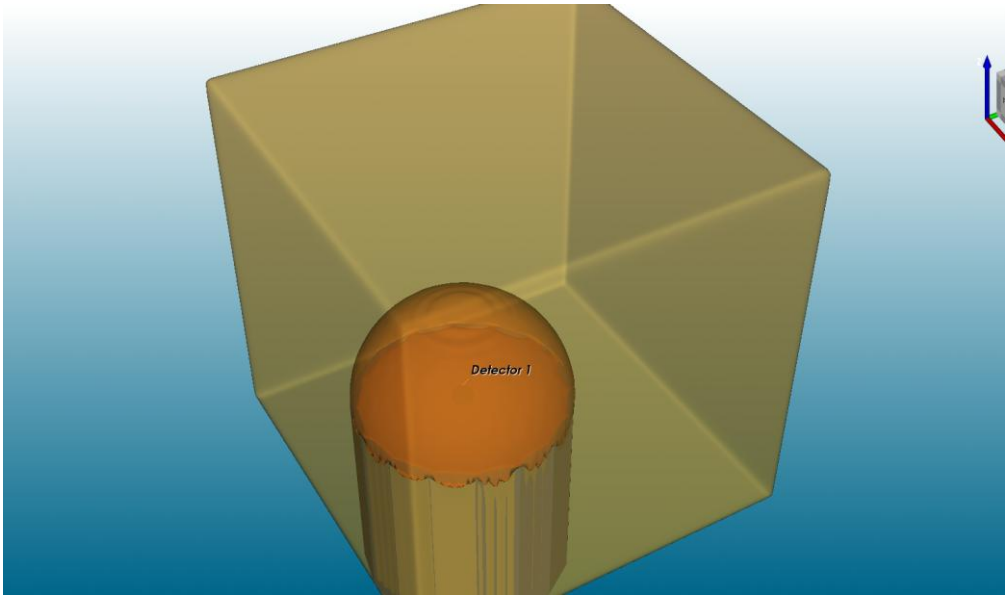
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.9 One OPGD with its FOI completely inside a cubical grade but outside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

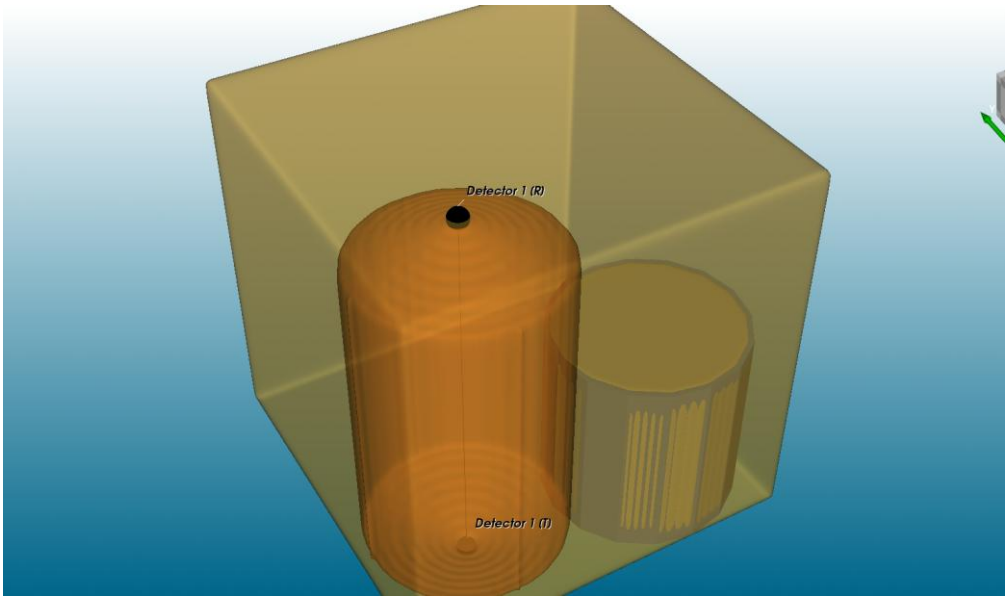
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

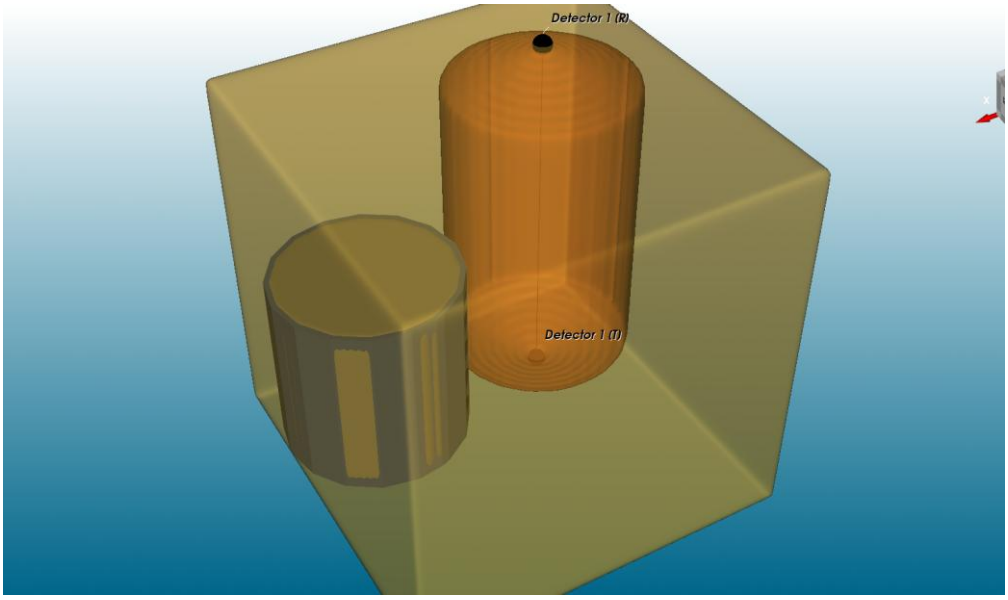
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - Low 10 m / High 9 m

Coverage Results

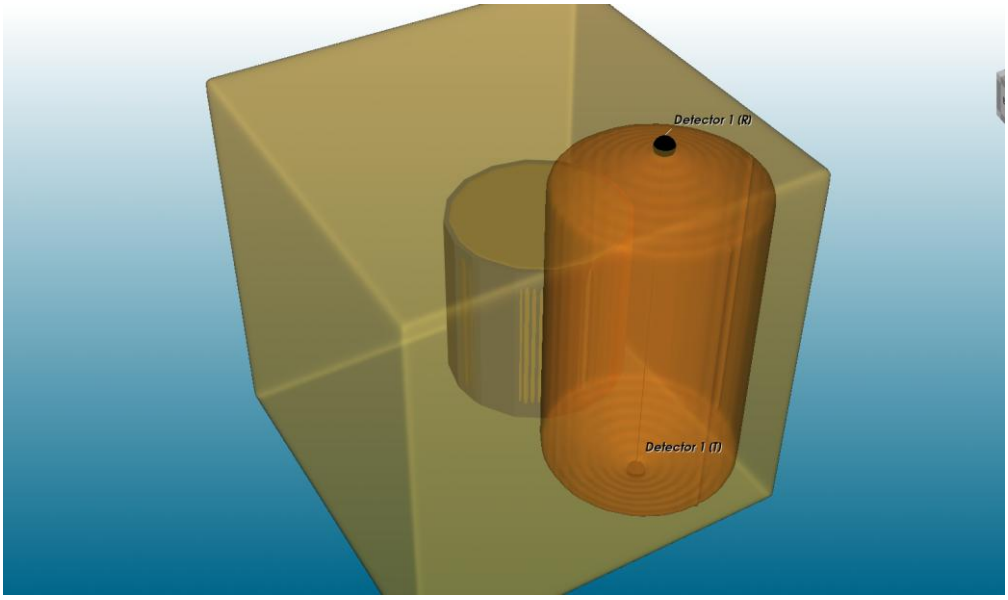
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	18.87	18.8	0.07
Grade A	1ooN	H	15.28	15.25	0.03



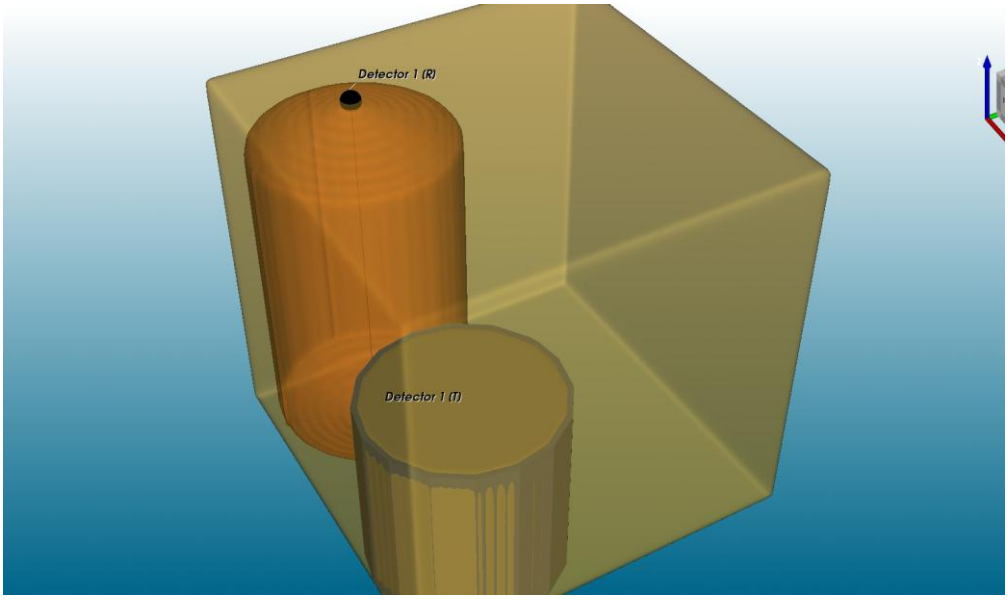
View 1 - L



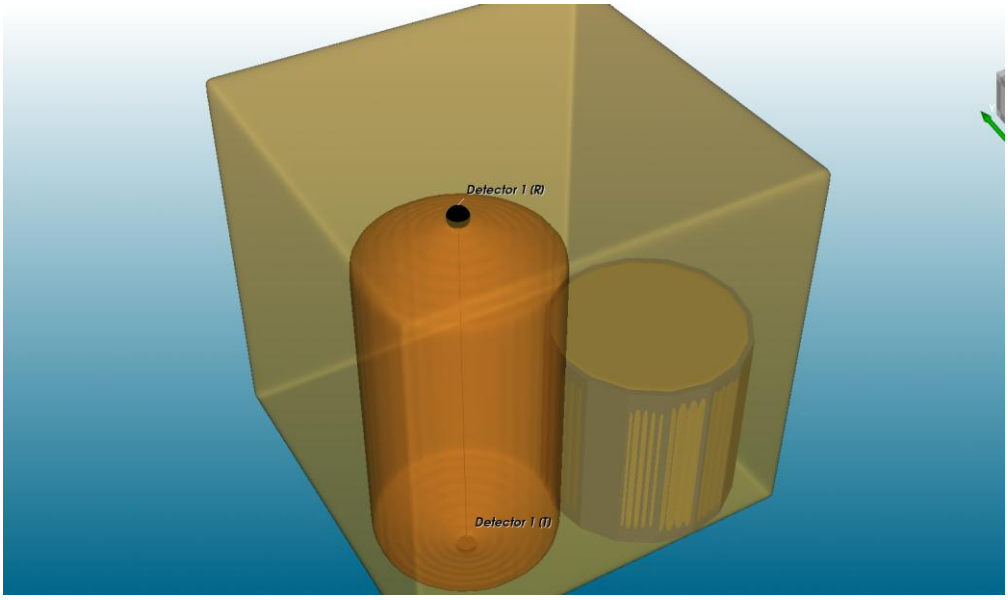
View 2 - L



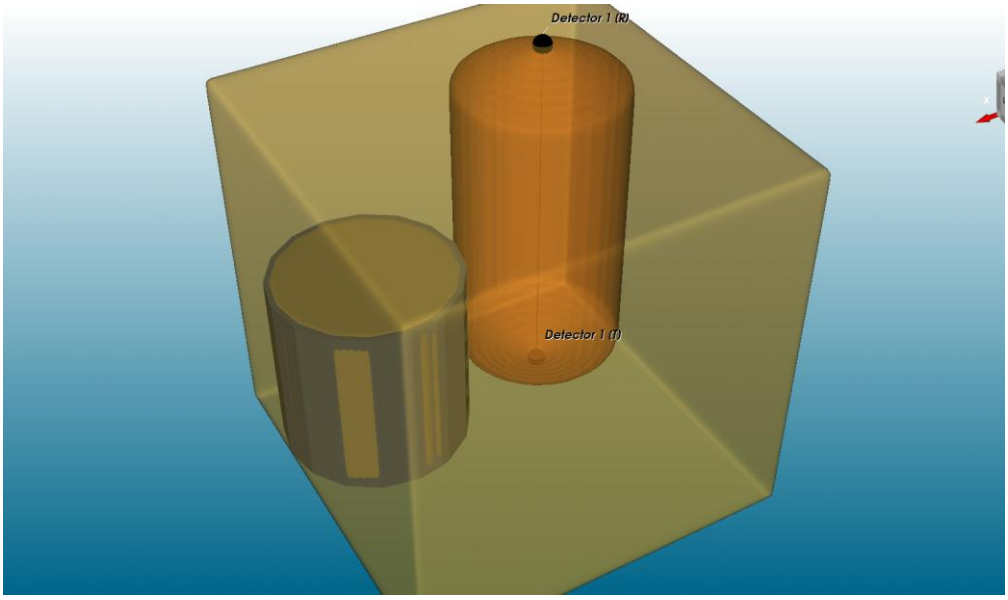
View 3 - L



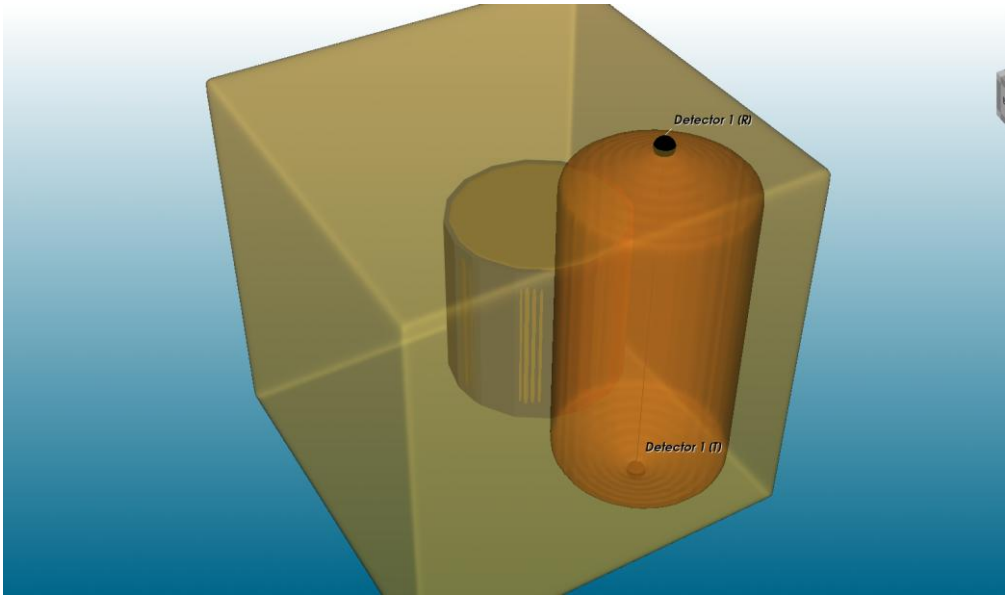
View 4 - L



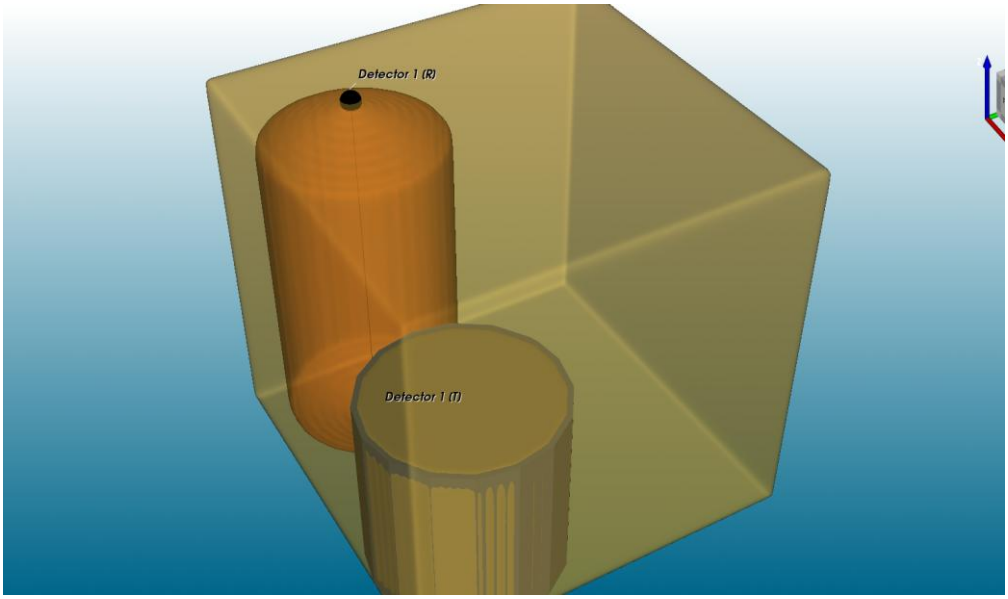
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.10 One OPGD with its FOI completely inside a cubical grade. Half portion of detector's FOI is inside a cylindrical geometry. Geometry volume is discounted from coverage calculation.

Risk Grades

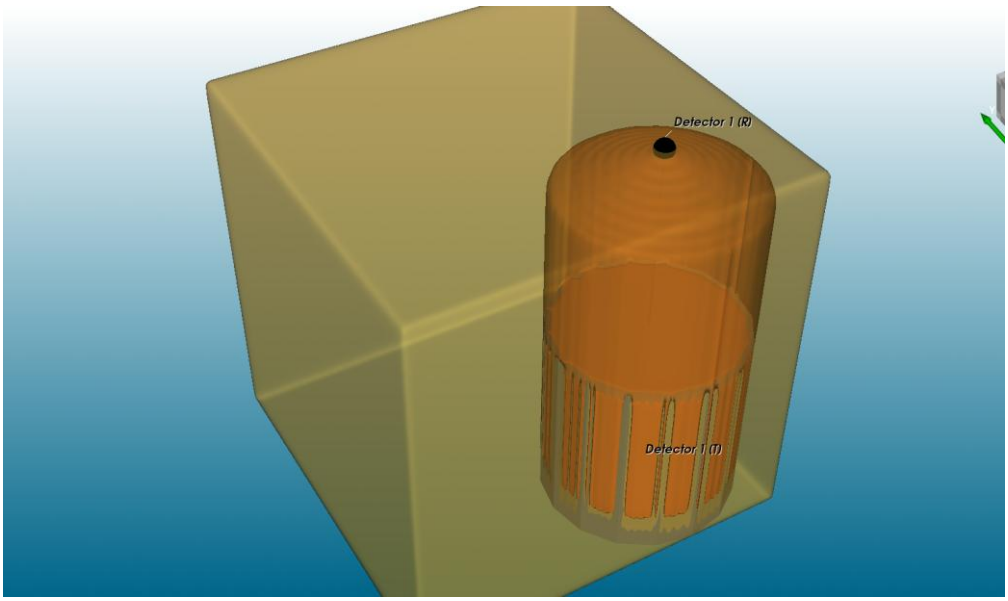
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

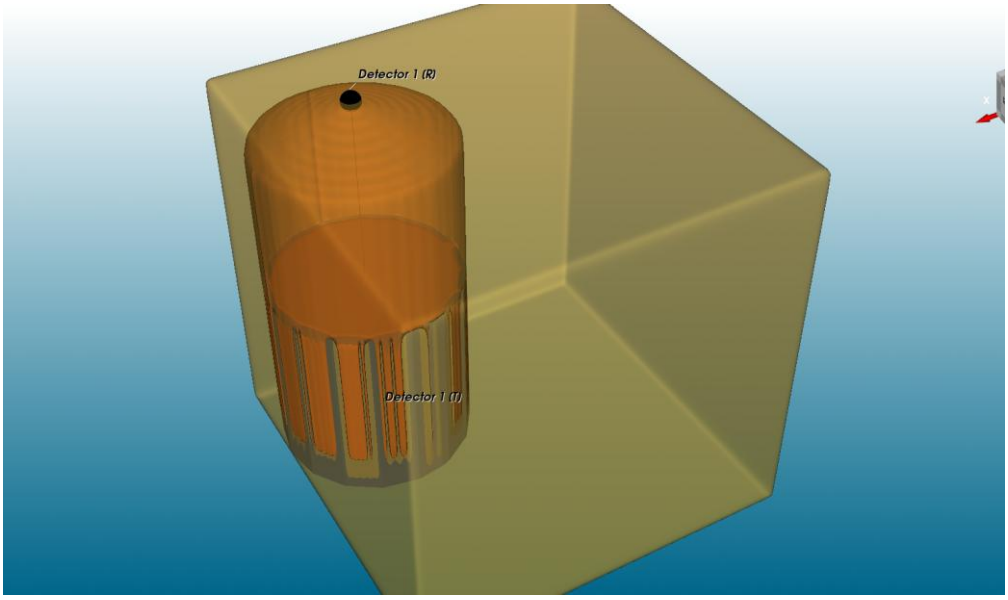
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade A - Low 10 m / High 9 m

Coverage Results

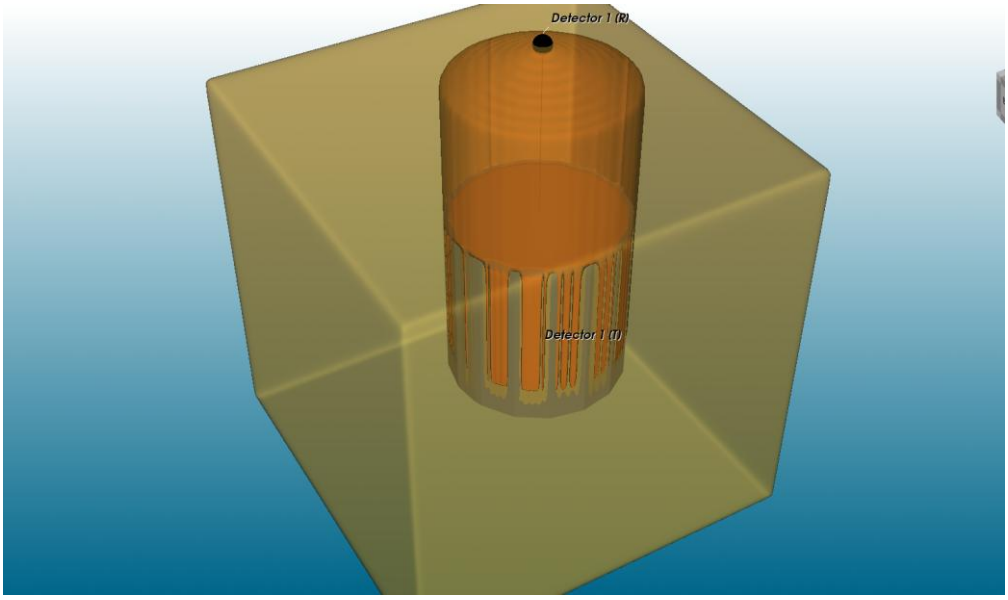
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	9.43	9.47	0.04
Grade A	1ooN	H	7.64	7.51	0.13



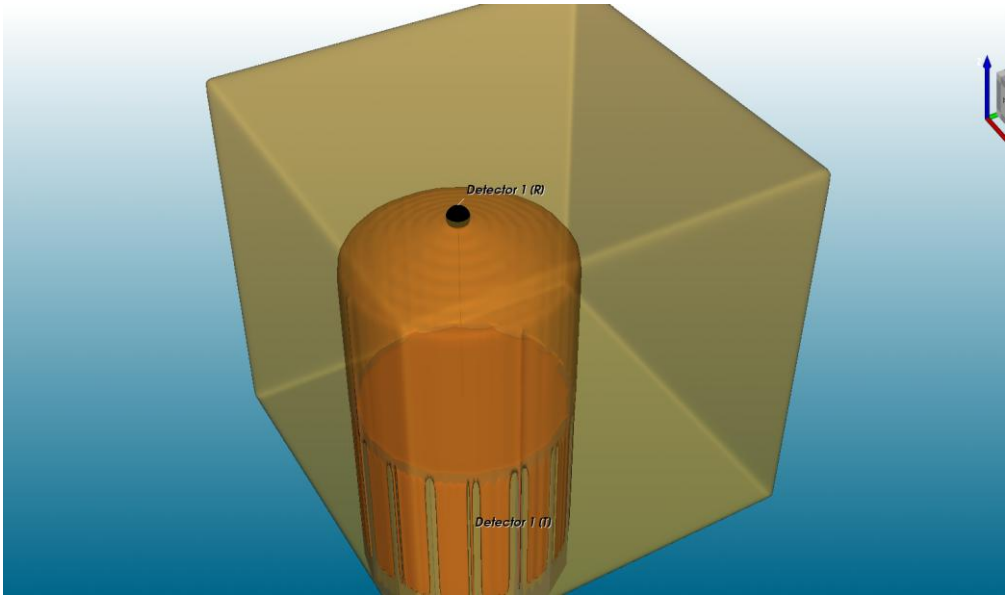
View 1 - L



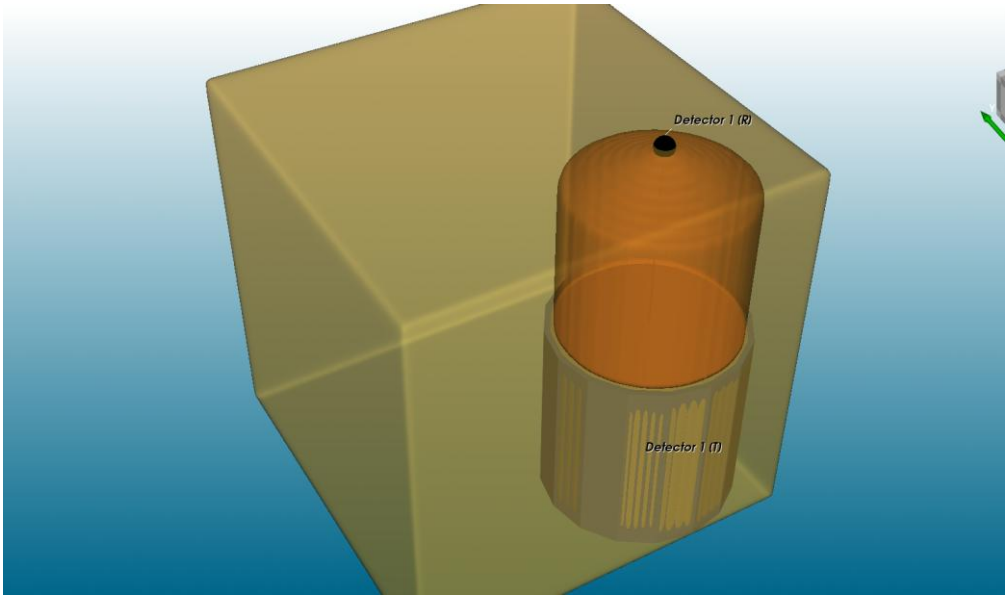
View 2 - L



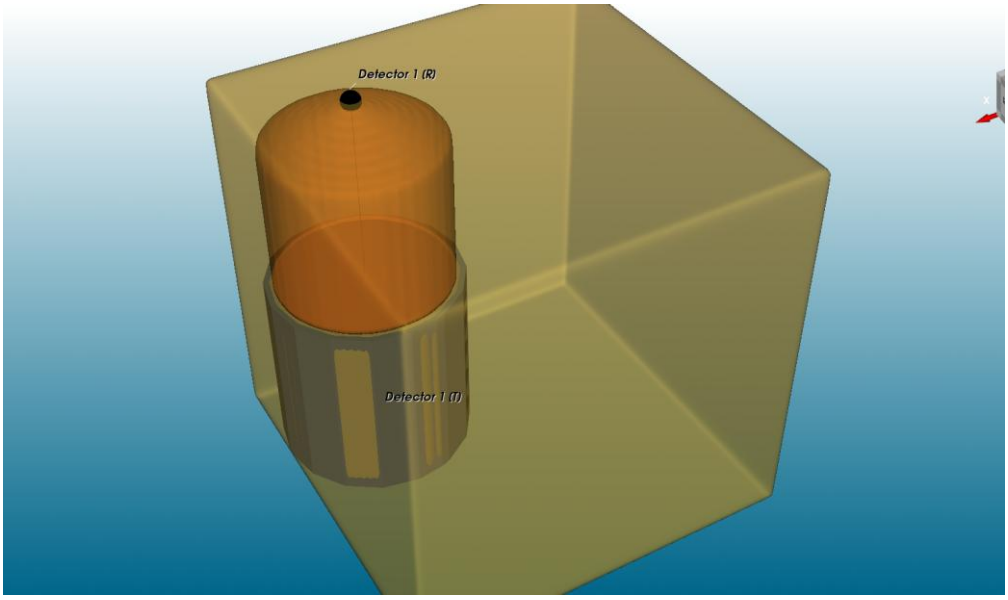
View 3 - L



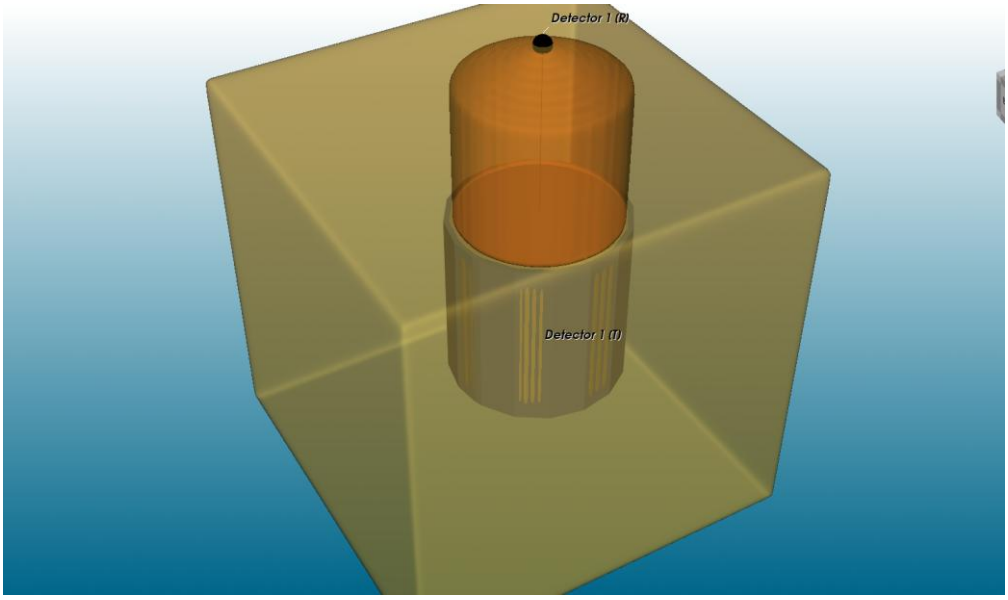
View 4 - L



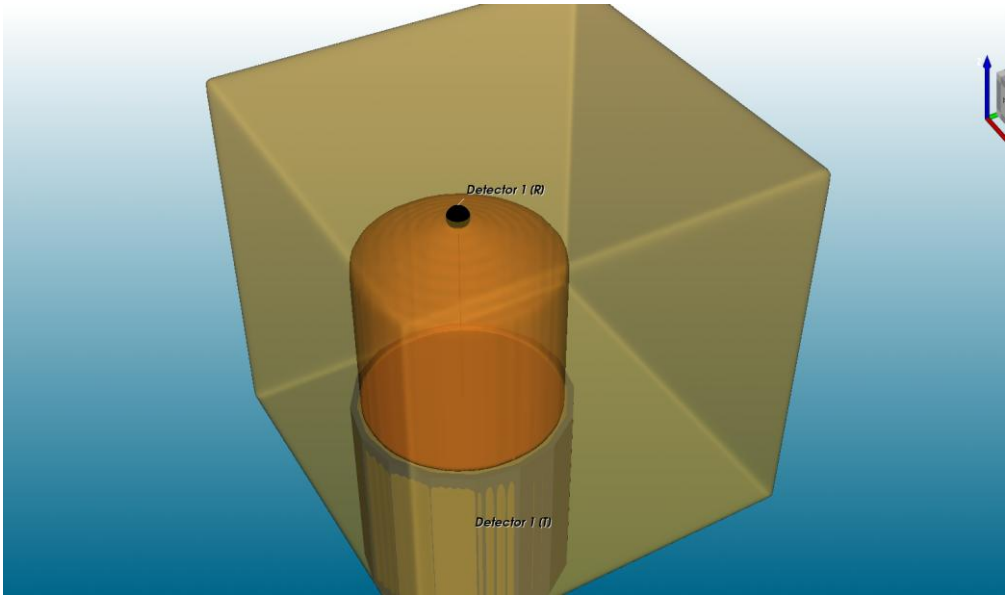
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.11 One PGD with its FOI completely inside a cubical grade but outside a cylindrical & a cubical geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

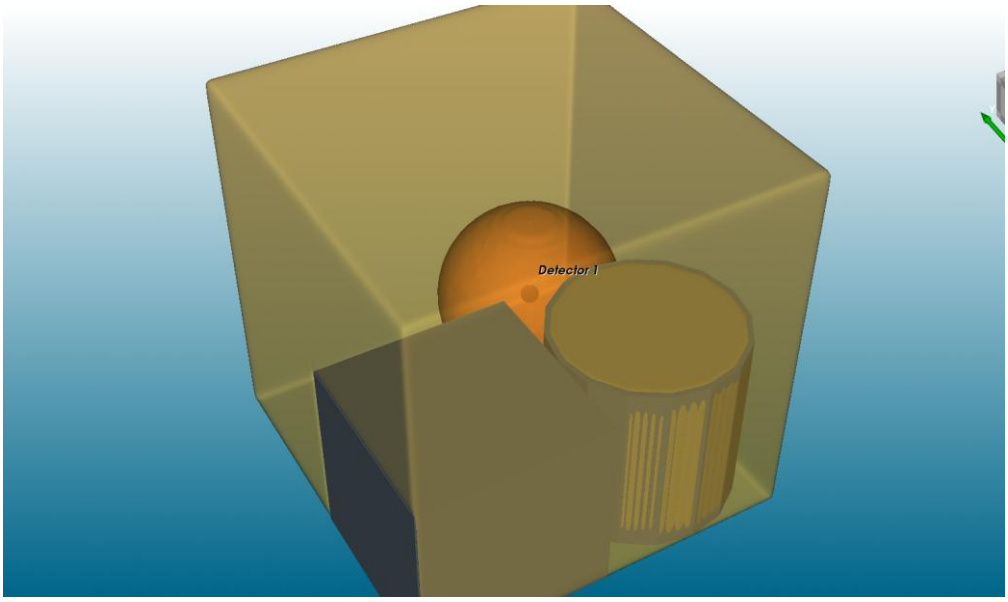
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D

Gas Detectors

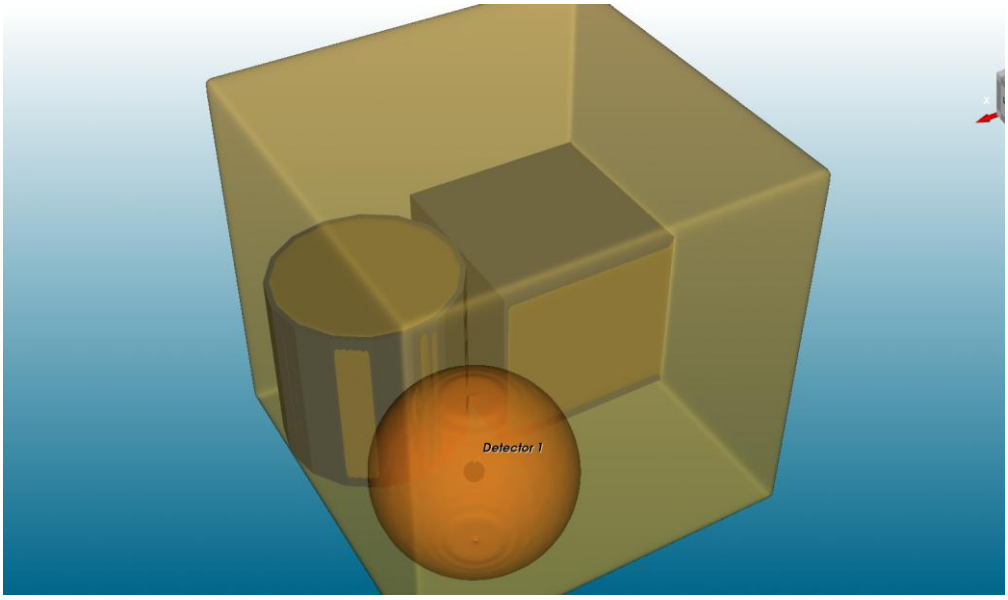
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - Low 10 m / High 8 m

Coverage Results

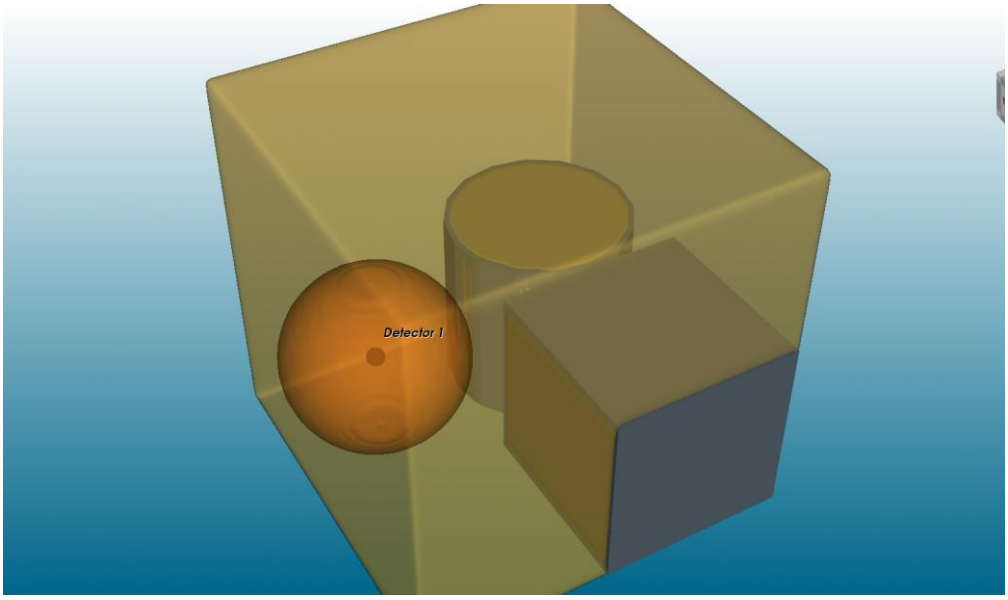
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	8.43	8.35	0.08
Grade D	1ooN	H	4.31	4.27	0.04



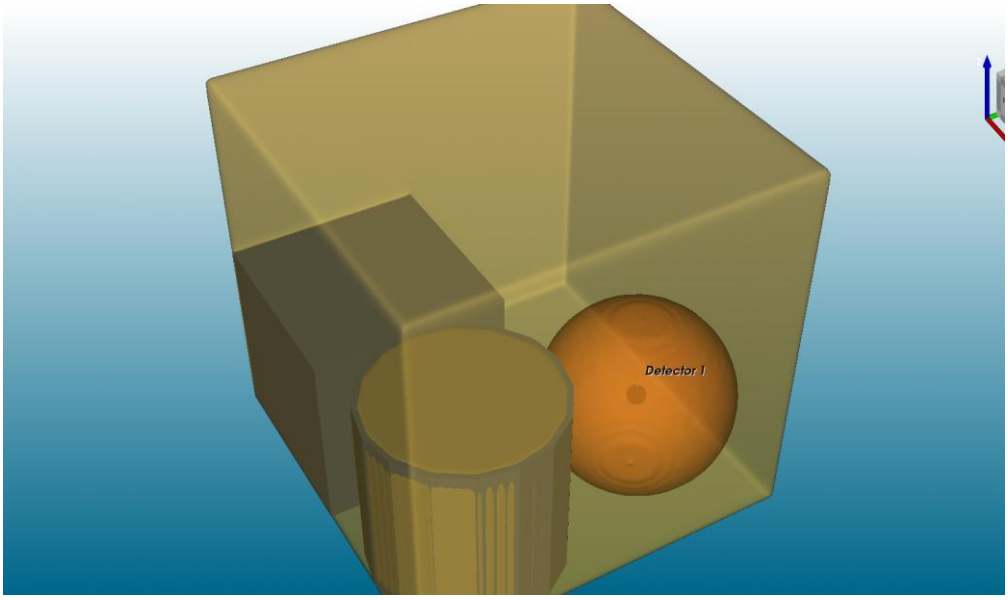
View 1 - L



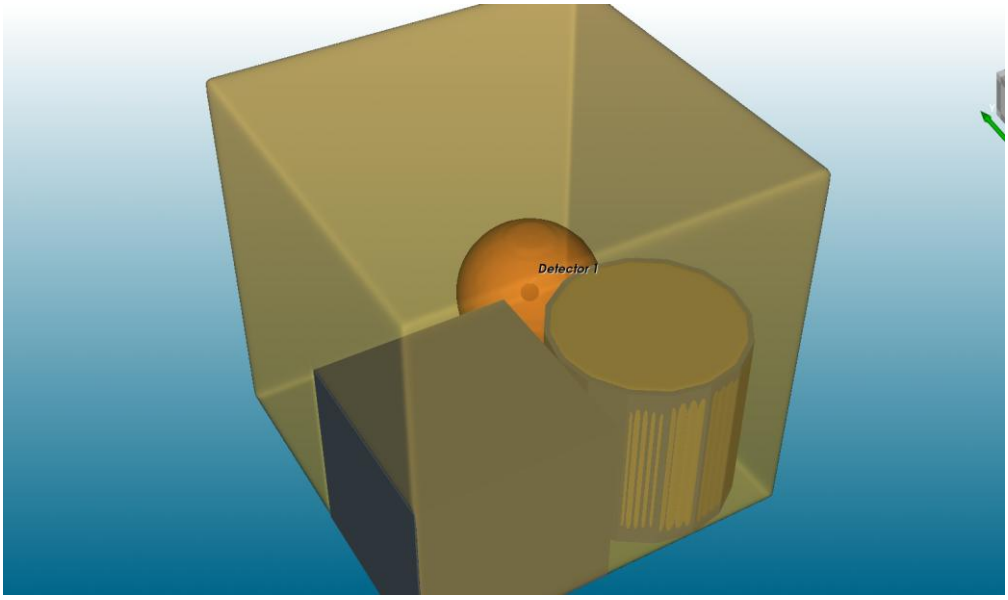
View 2 - L



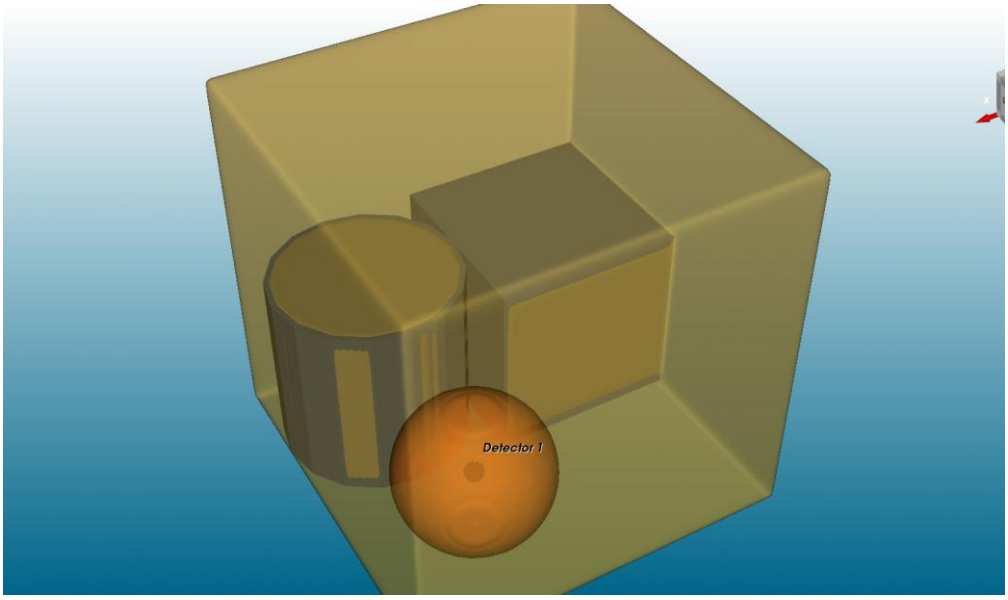
View 3 - L



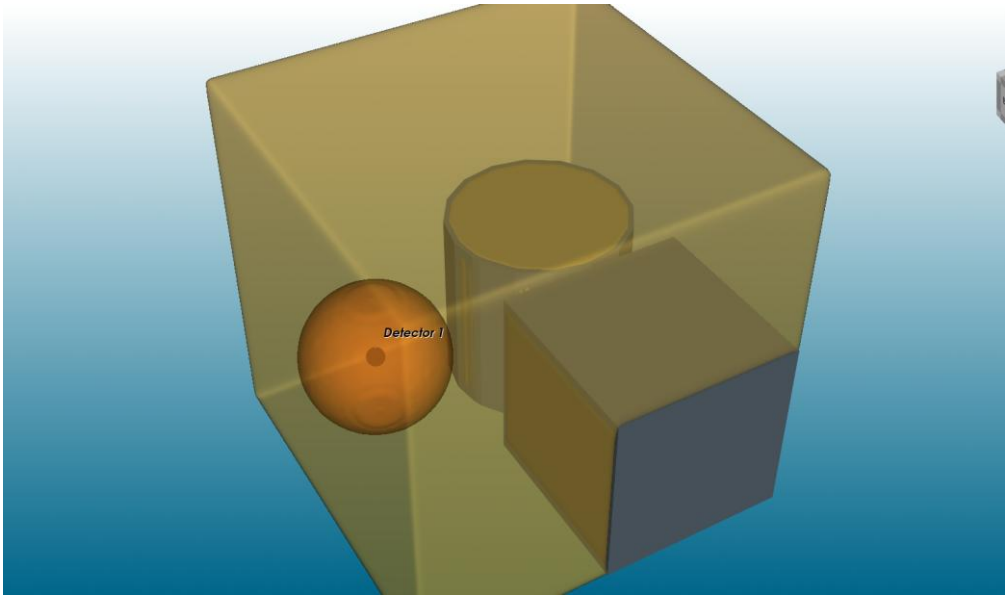
View 4 - L



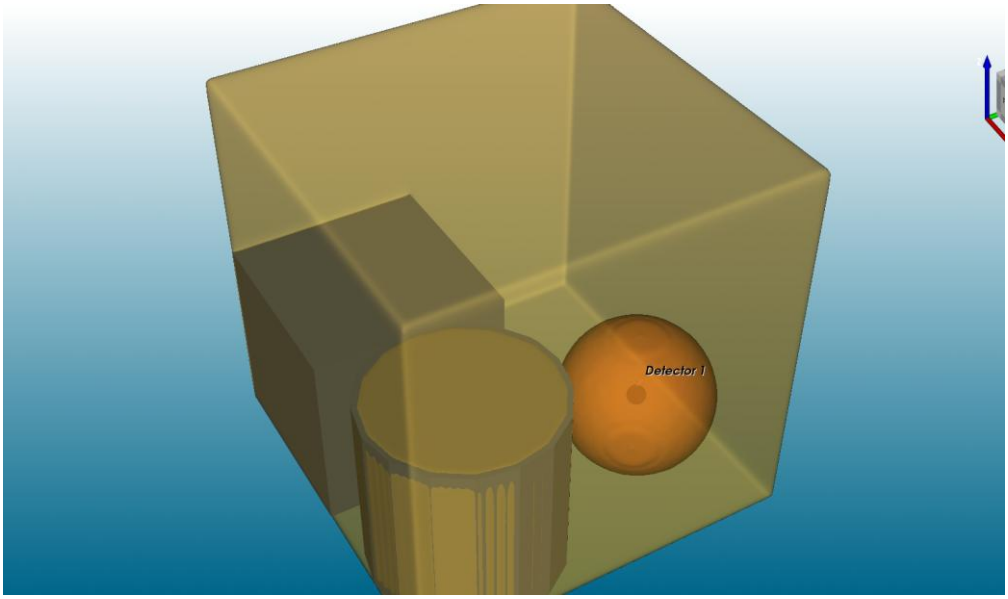
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.12 One OPGD with its FOI completely inside a cubical grade but outside a cylindrical & a cubical geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

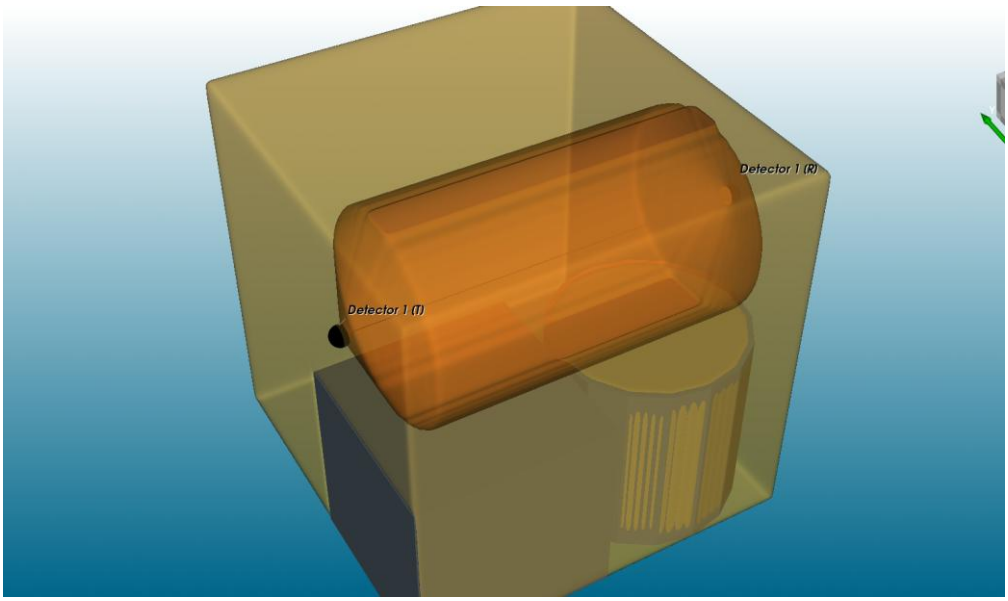
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

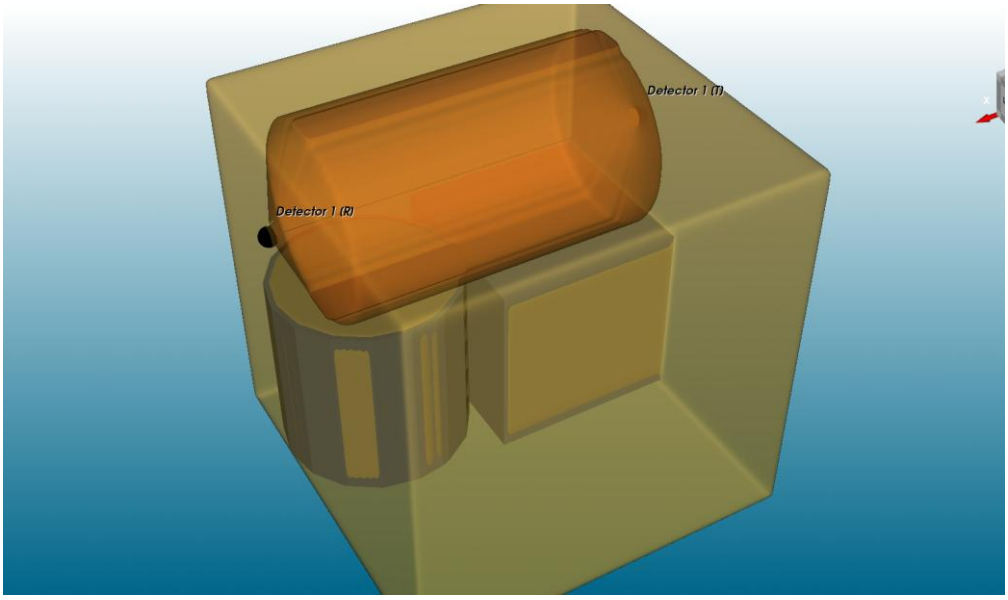
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 5 m

Coverage Results

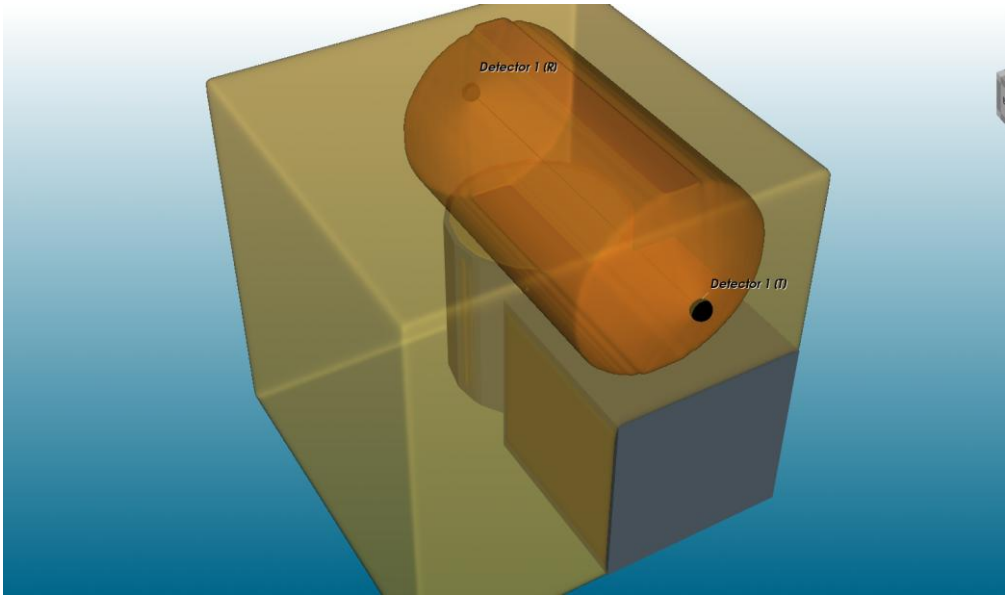
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	21.91	21.69	0.22
Grade C	1ooN	H	5.48	5.45	0.03



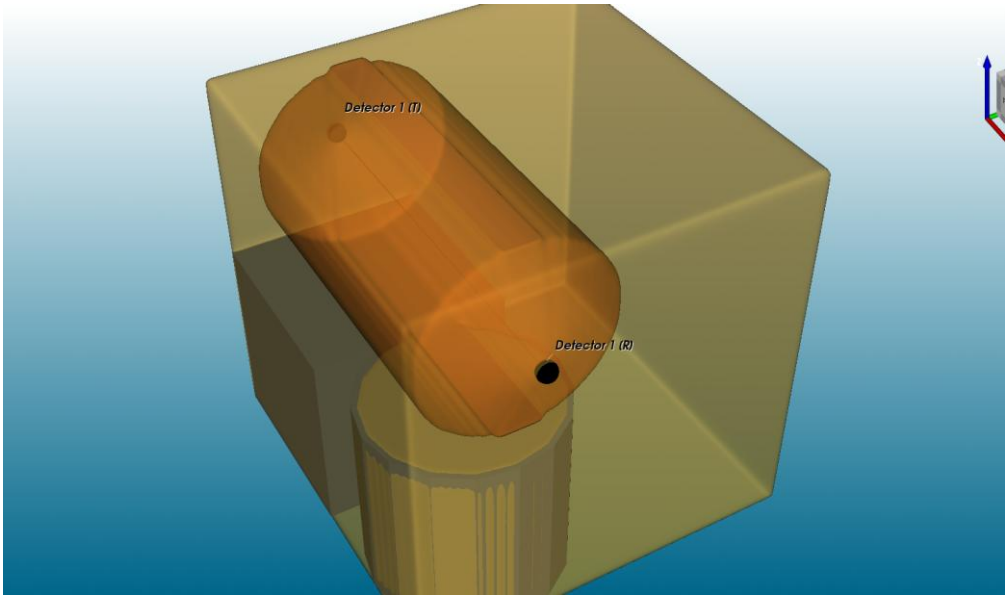
View 1 - L



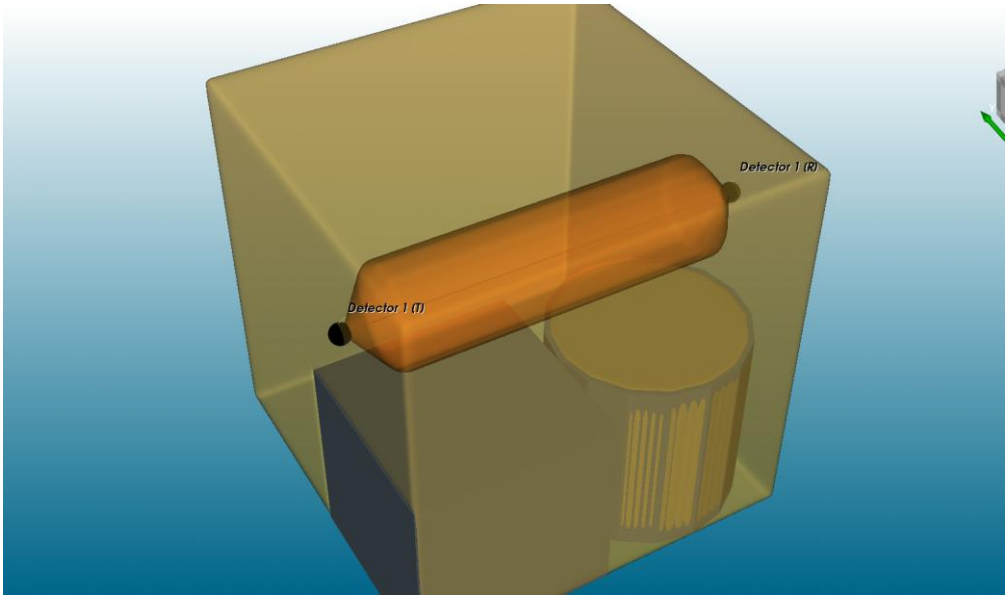
View 2 - L



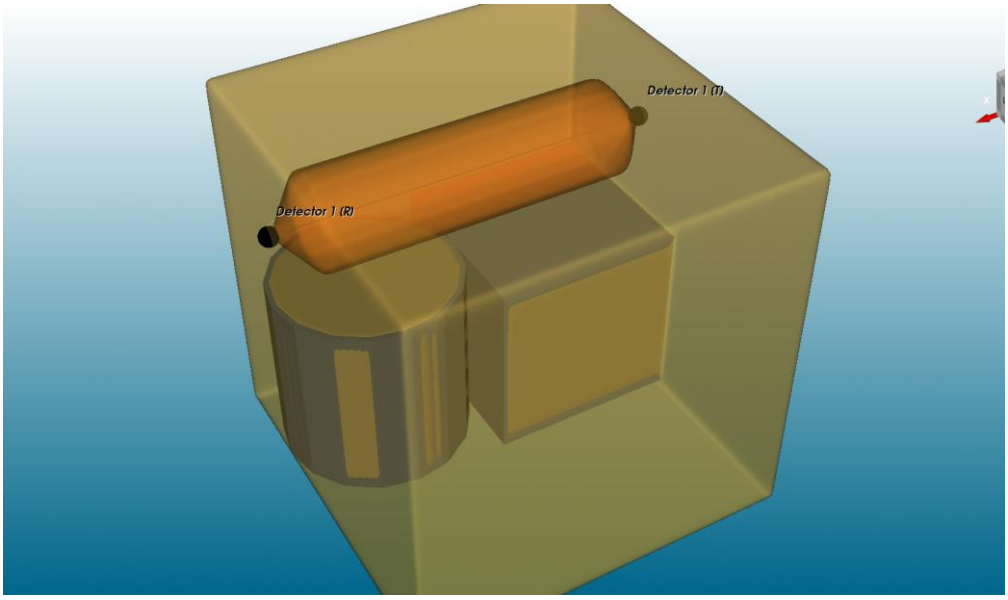
View 3 - L



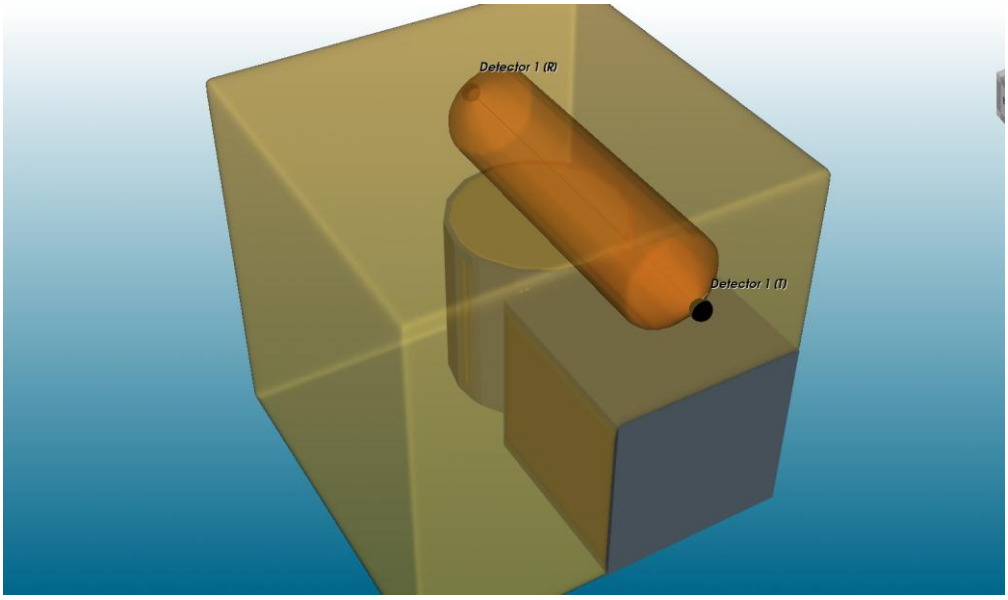
View 4 - L



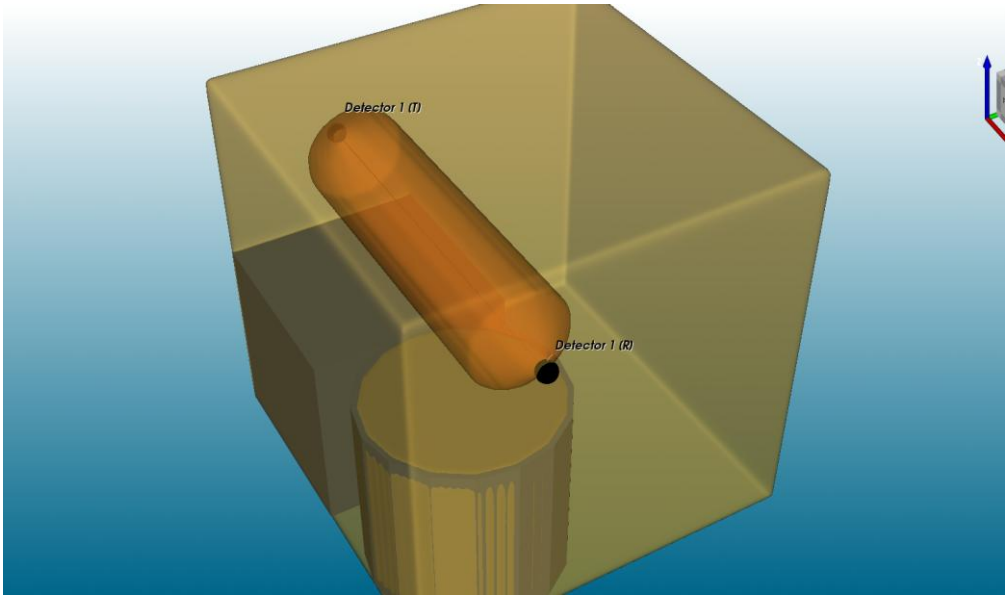
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.13 Two same type cubical grades used. One grade (Open type) surrounds a cubical gemoetry. Another grade (again open type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

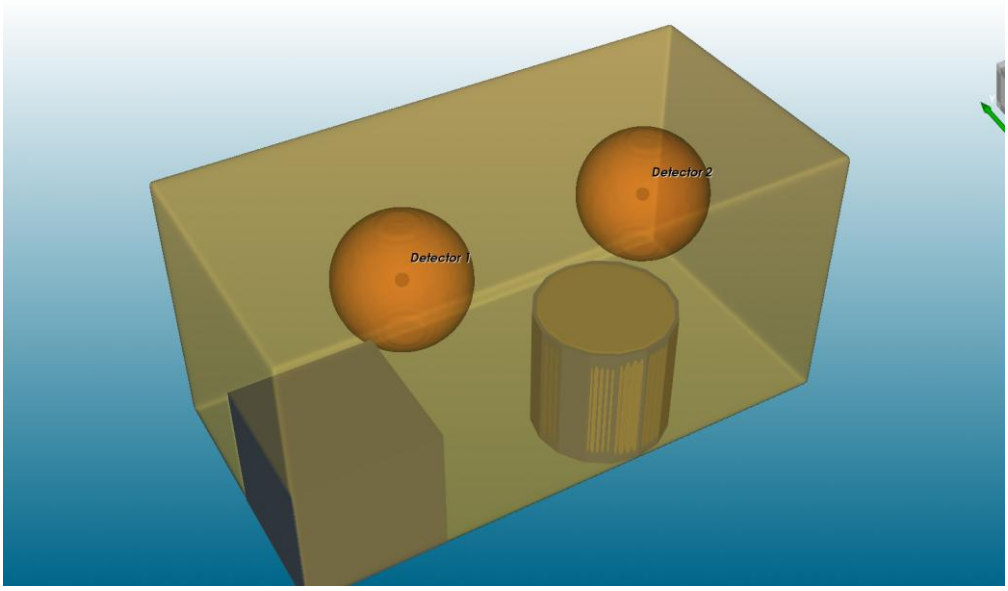
Gas Detectors

Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 8 m
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 8 m

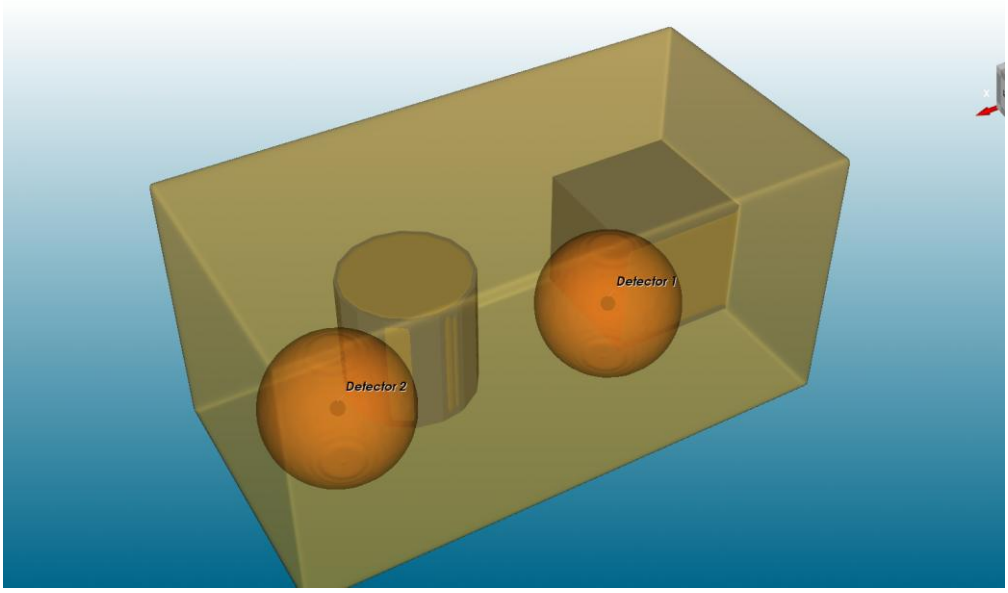
Coverage Results

Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	7.37	7.33	0.04
Grade A	1ooN	H	3.77	3.75	0.02

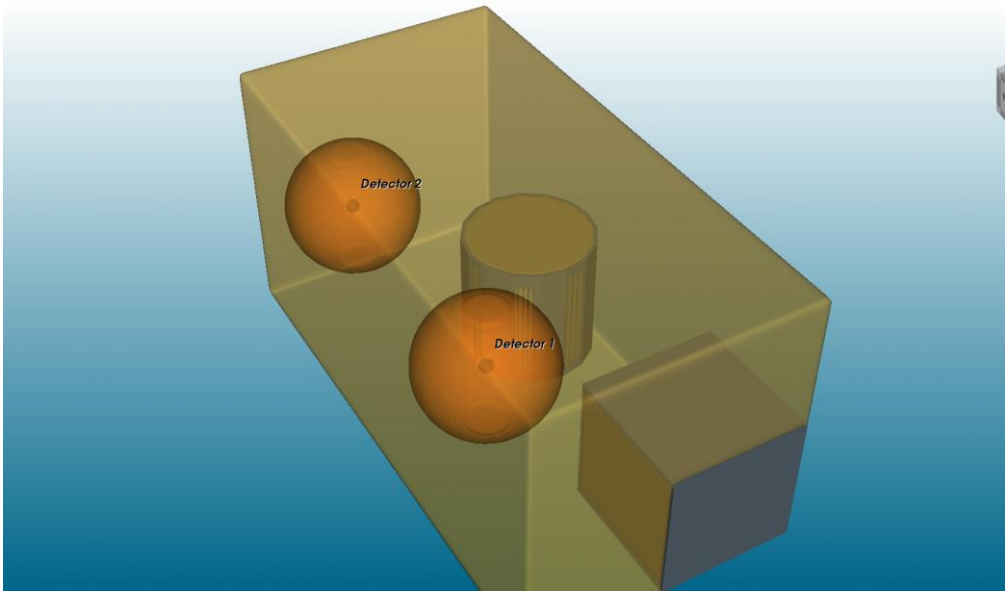
Note: Two independent grades, each with its own detector clear of its own geometry piece.



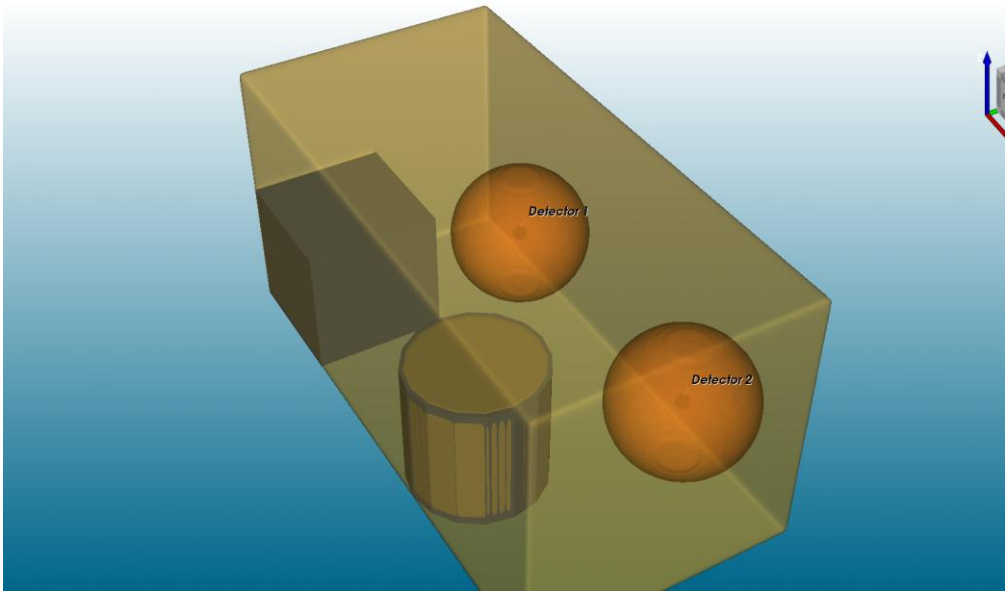
View 1 - L



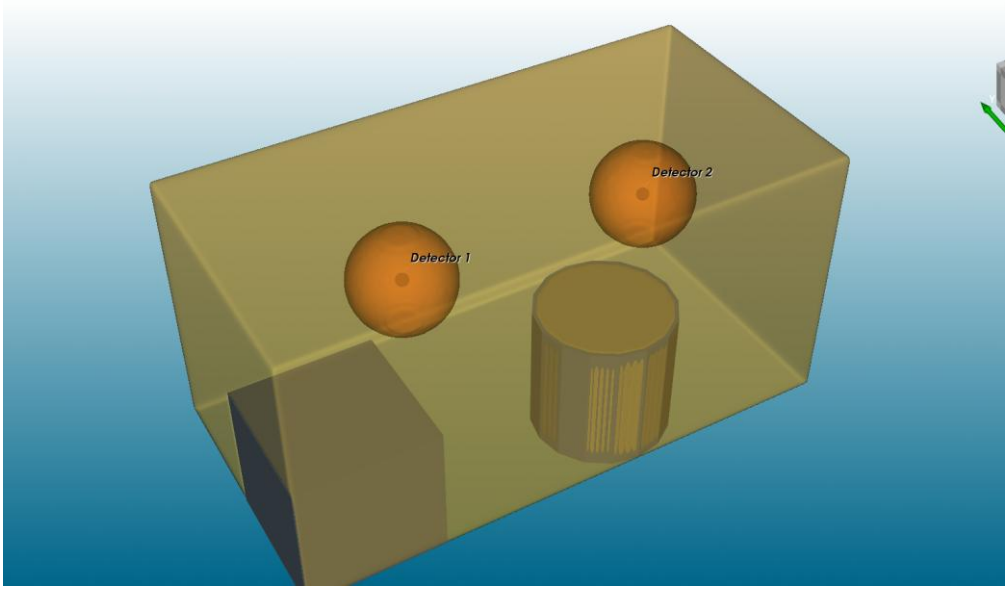
View 2 - L



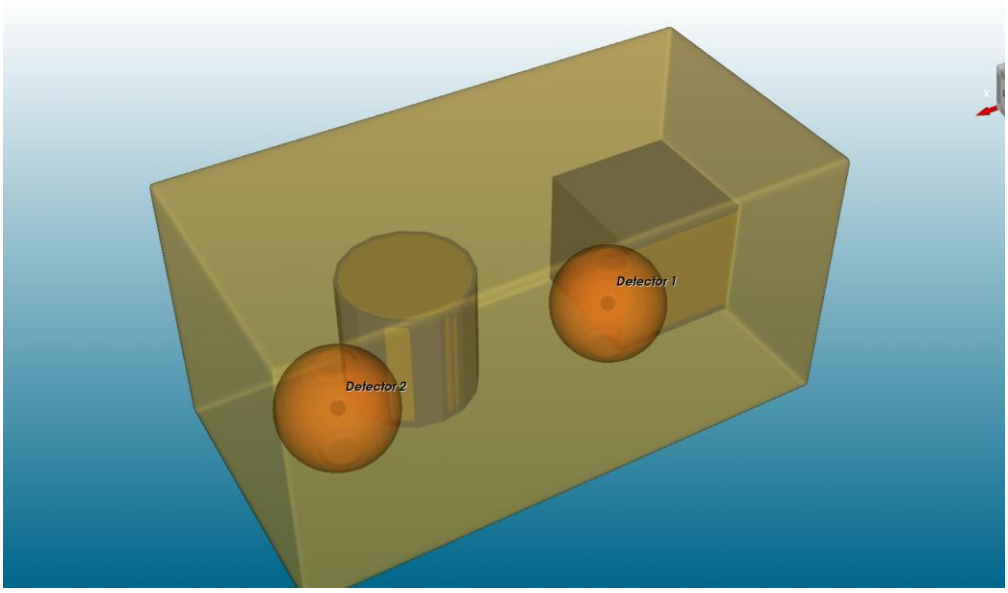
View 3 - L



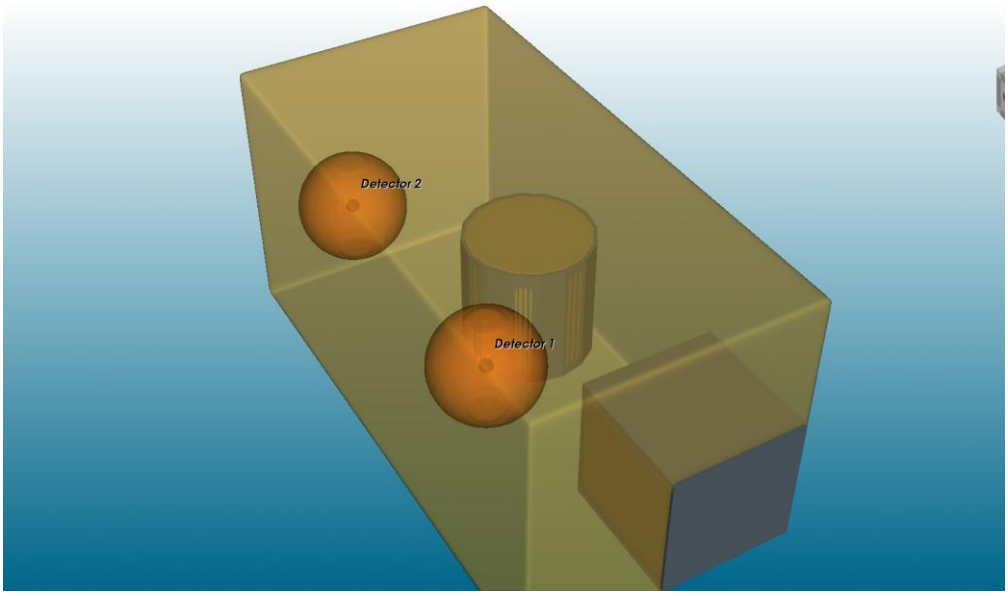
View 4 - L



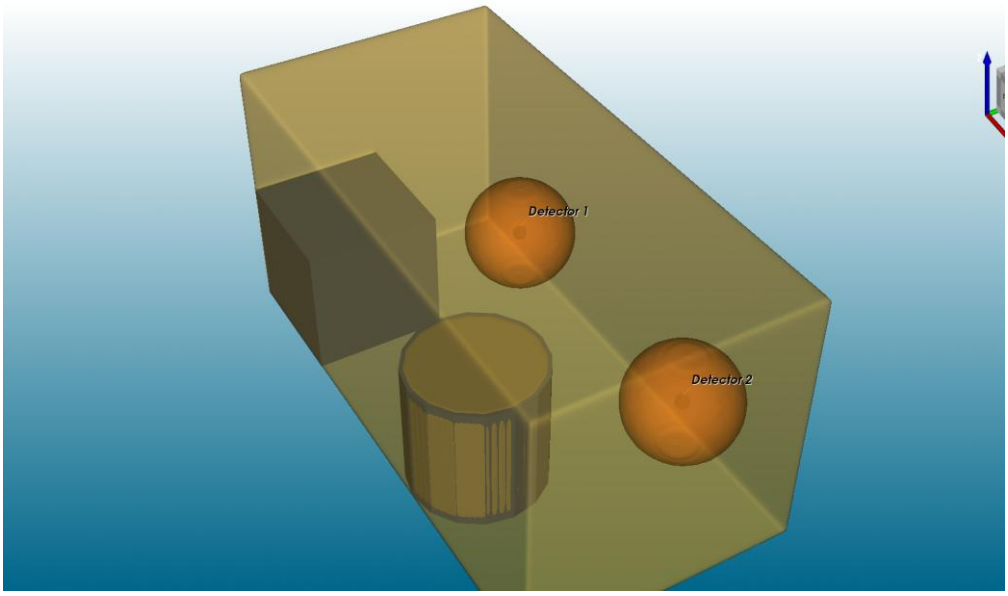
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.14 Two different types cubical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

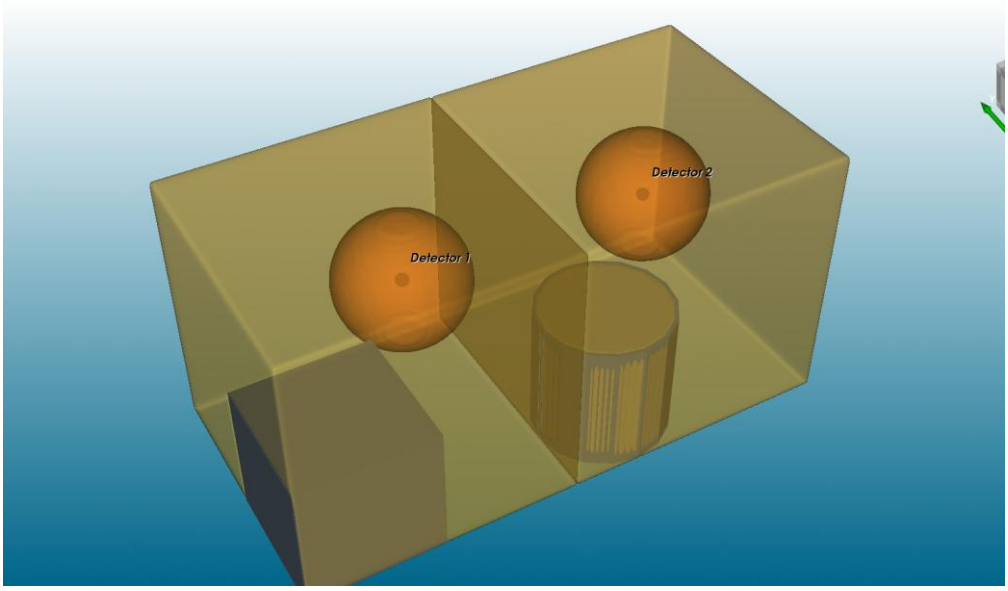
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

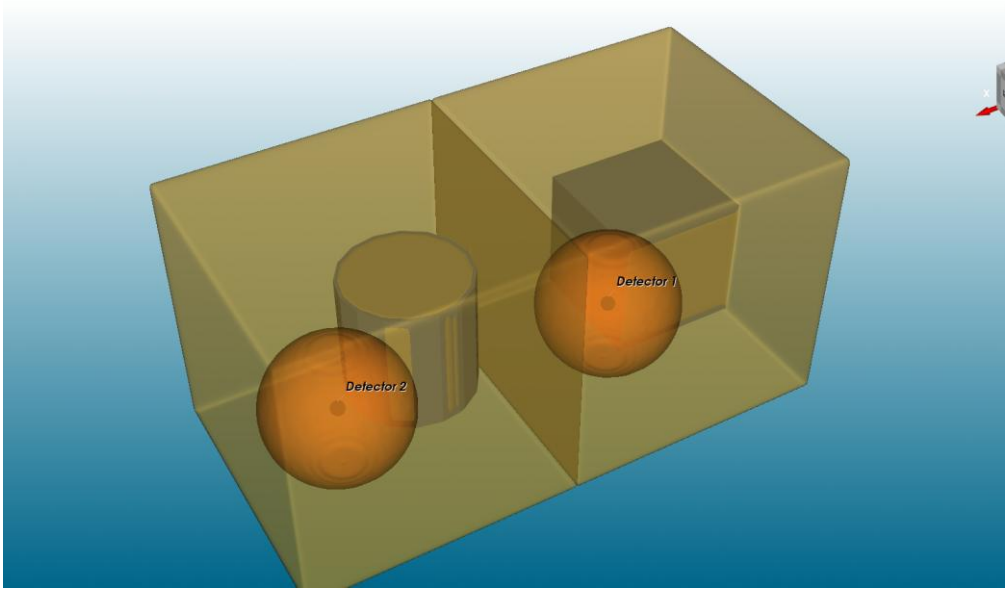
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade D - Low 10 m / High 8 m Grade A - Low 10 m / High 8 m
Point Gas Detector (PGD)	HC	Grade D - Low 10 m / High 8 m Grade A - Low 10 m / High 8 m

Coverage Results

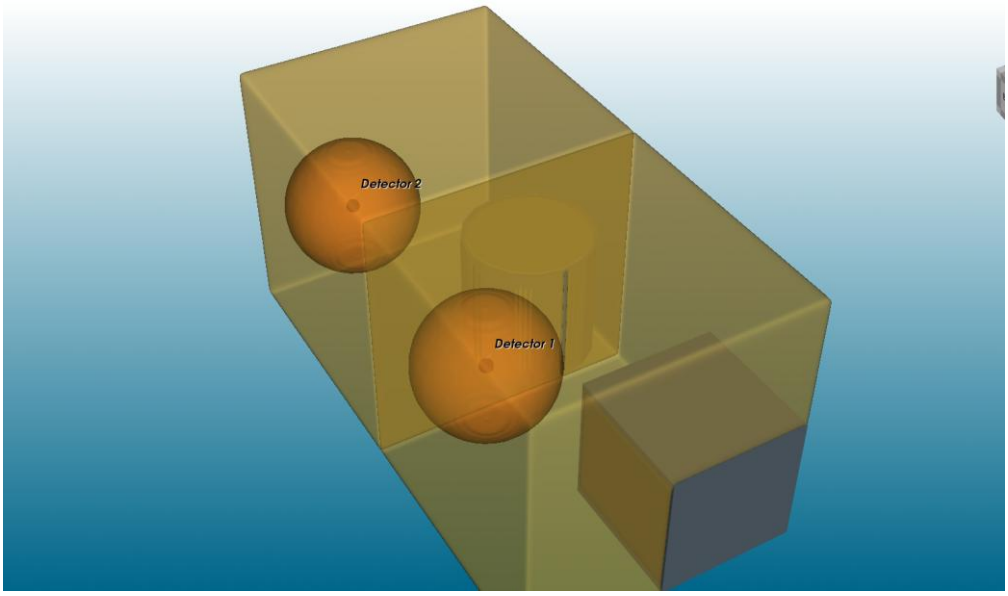
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	7.48	7.44	0.04
Grade A	1ooN	L	7.26	7.23	0.03
Grade D	1ooN	H	3.83	3.8	0.03
Grade A	1ooN	H	3.72	3.7	0.02



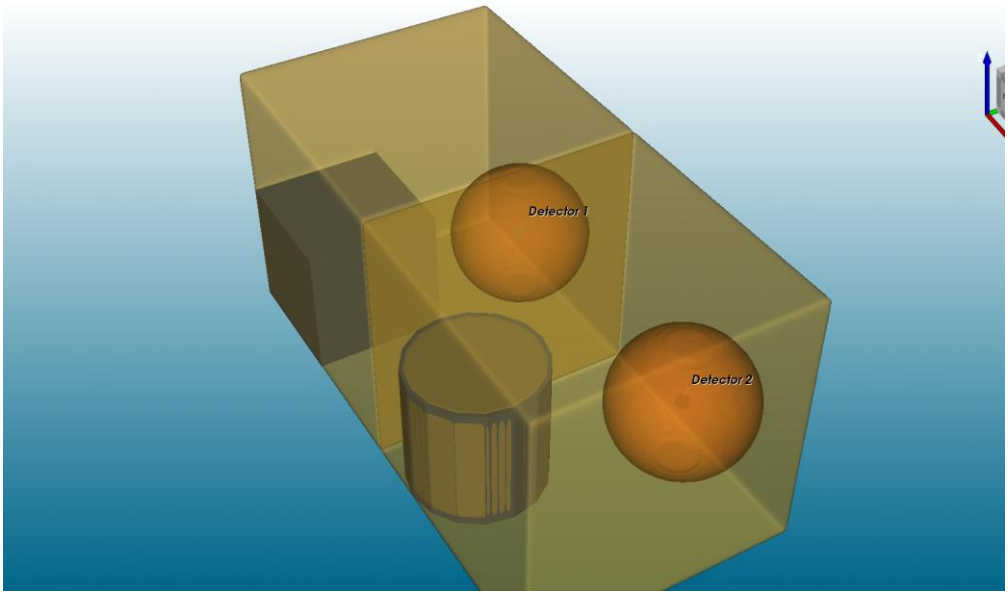
View 1 - L



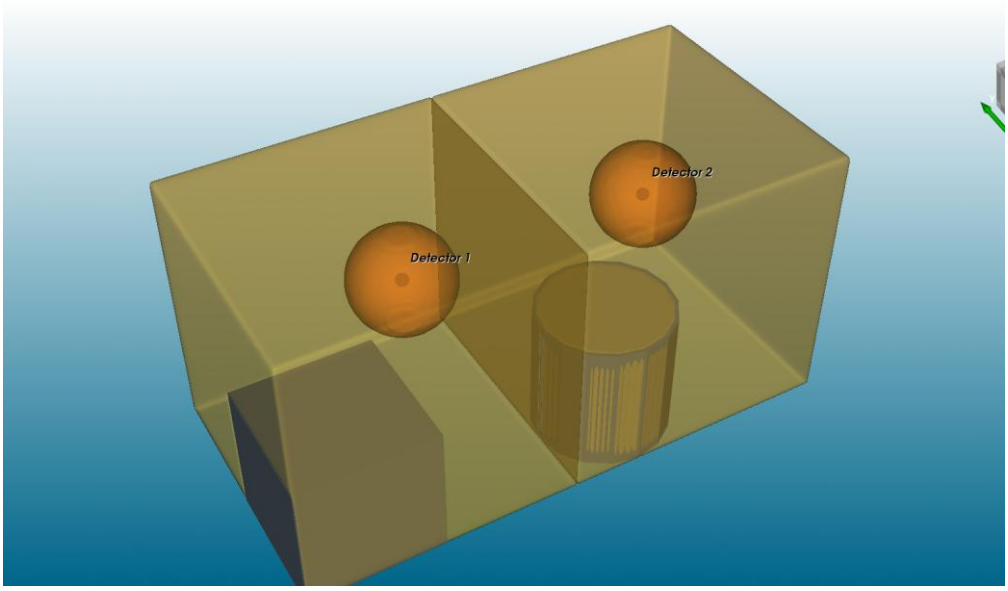
View 2 - L



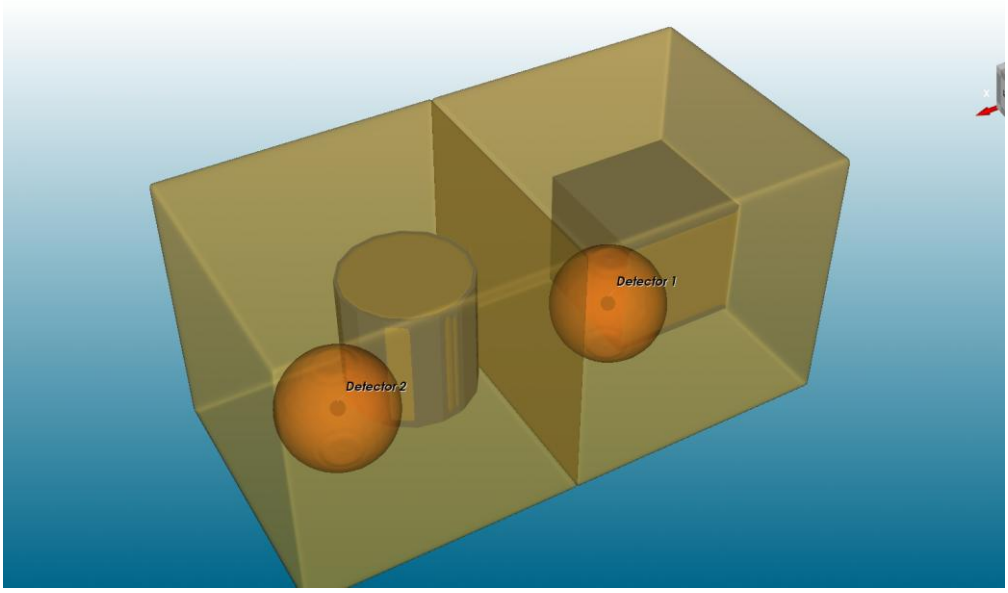
View 3 - L



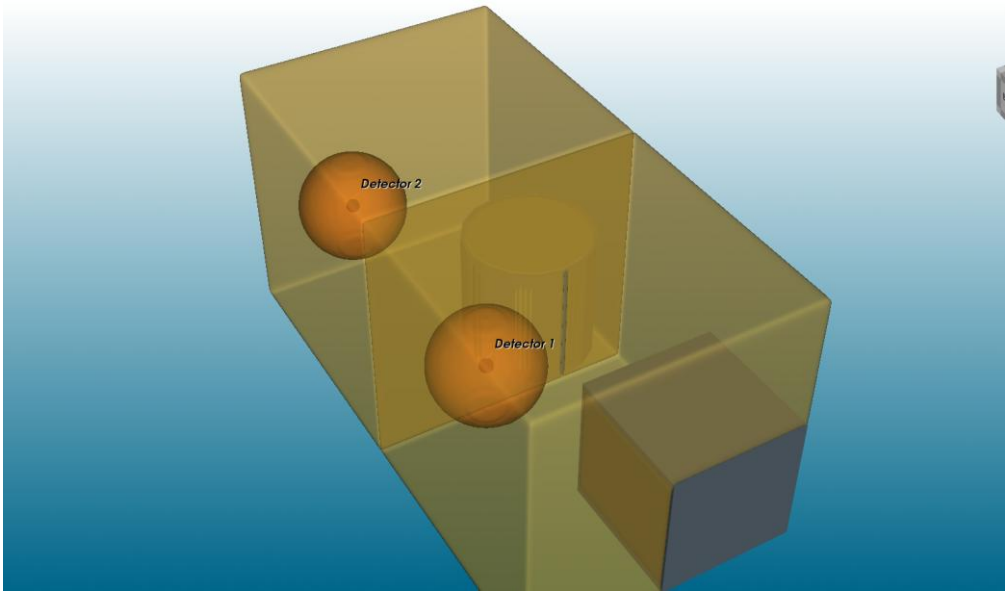
View 4 - L



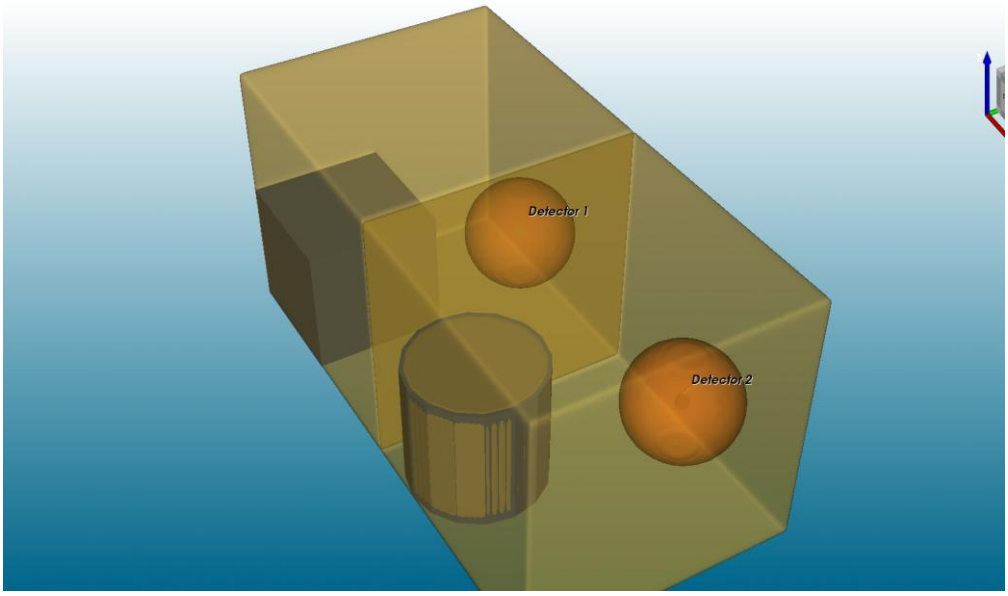
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.15 Two same type cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (again open type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

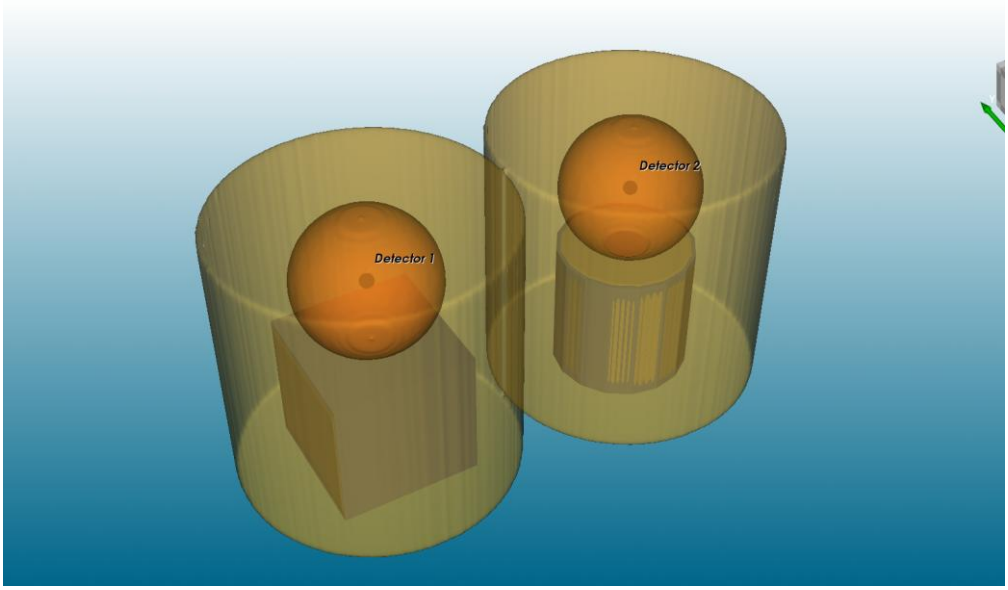
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade A
Cylinder	Radius 10 m, Height 20 m	Grade A

Gas Detectors

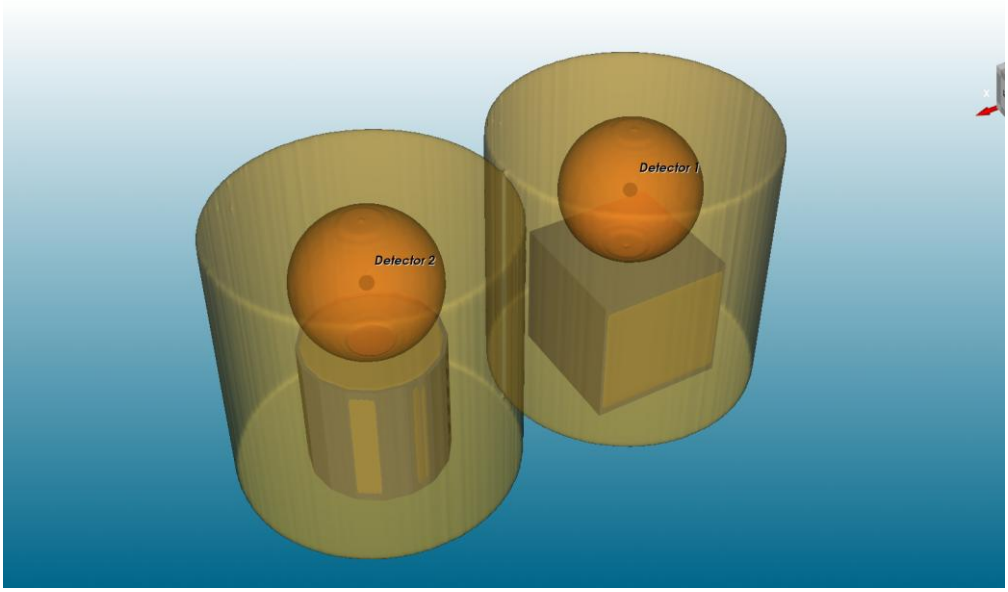
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 5 m
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 5 m

Coverage Results

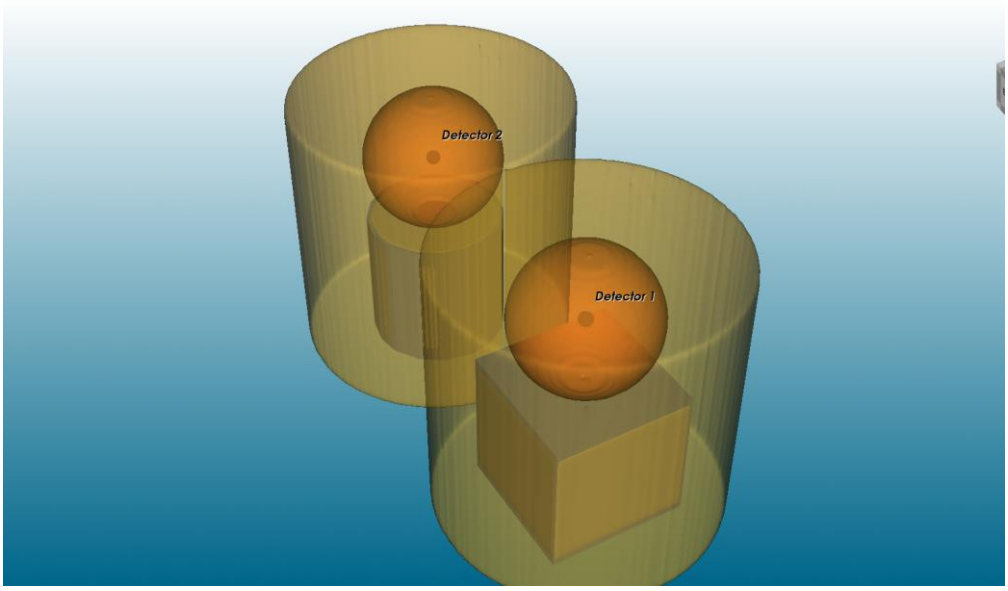
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	9.71	9.67	0.04
Grade A	1ooN	H	1.21	1.21	0.00



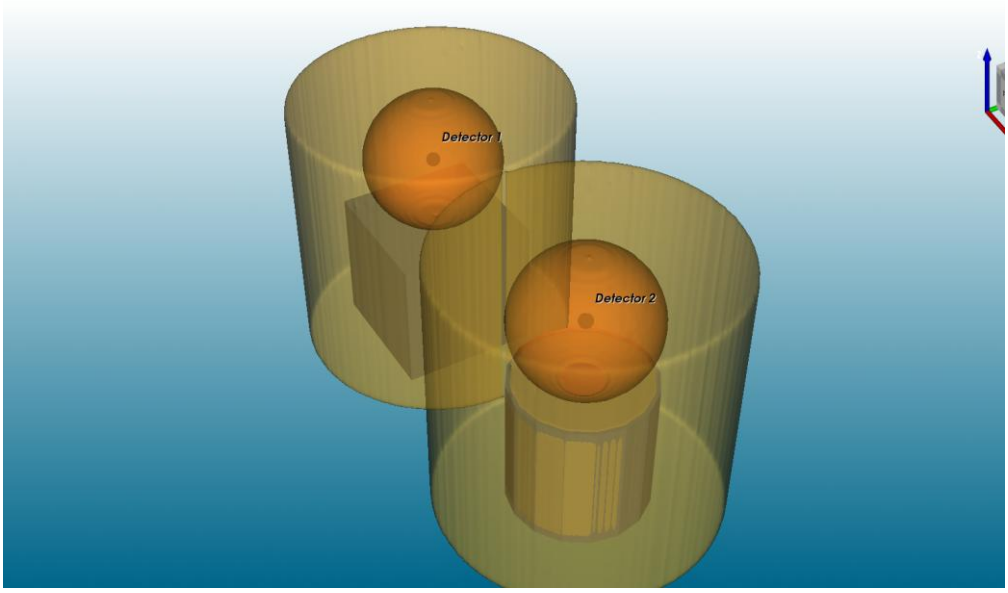
View 1 - L



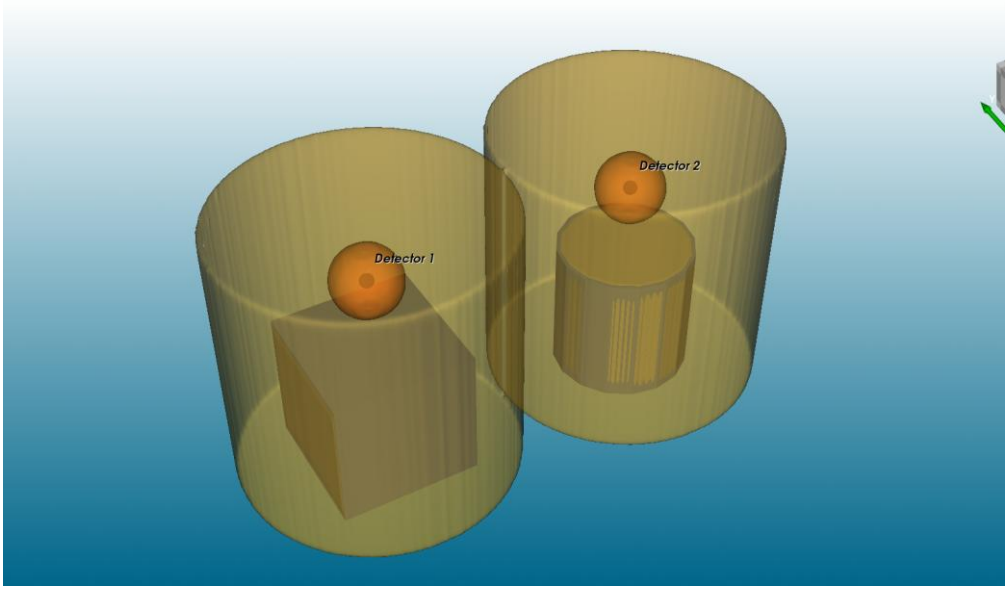
View 2 - L



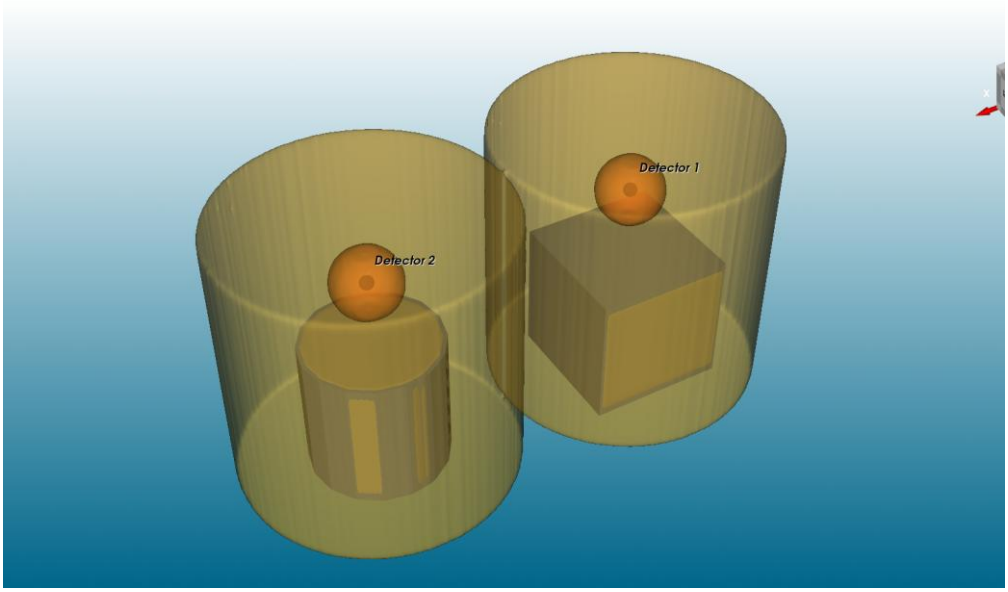
View 3 - L



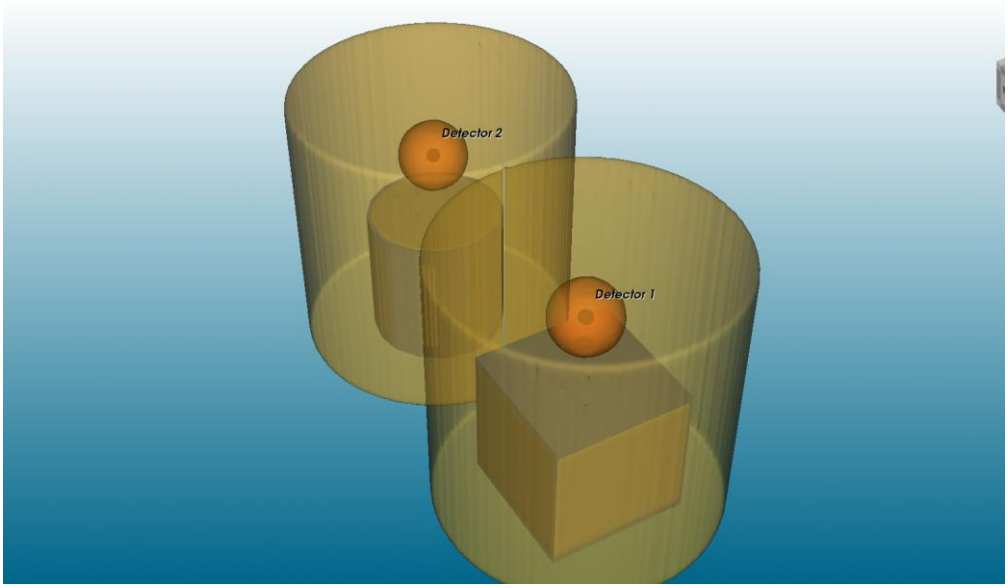
View 4 - L



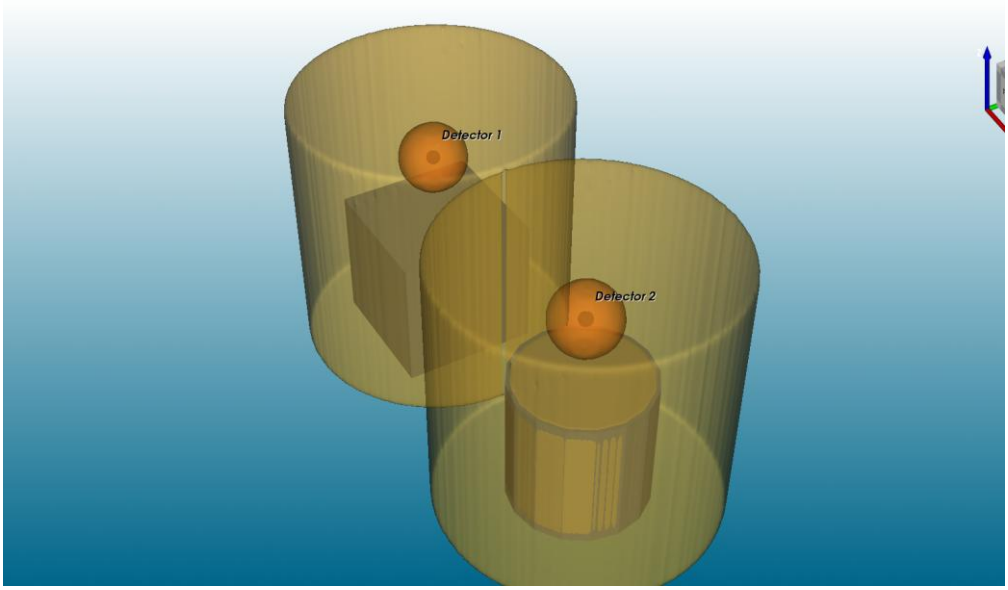
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.16 Two same type cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (again open type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but half portion of FOI being outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

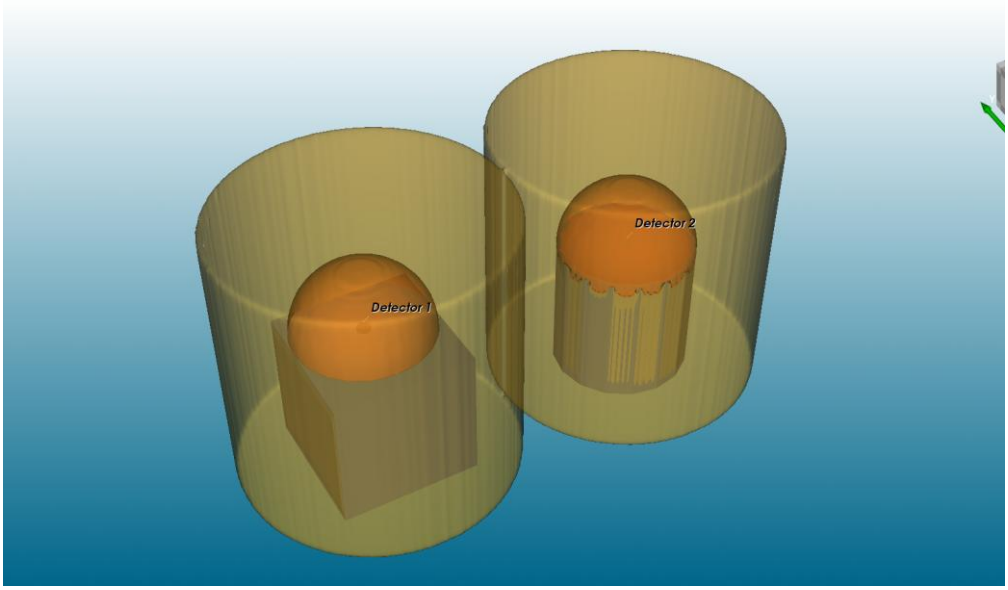
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade A
Cylinder	Radius 10 m, Height 20 m	Grade A

Gas Detectors

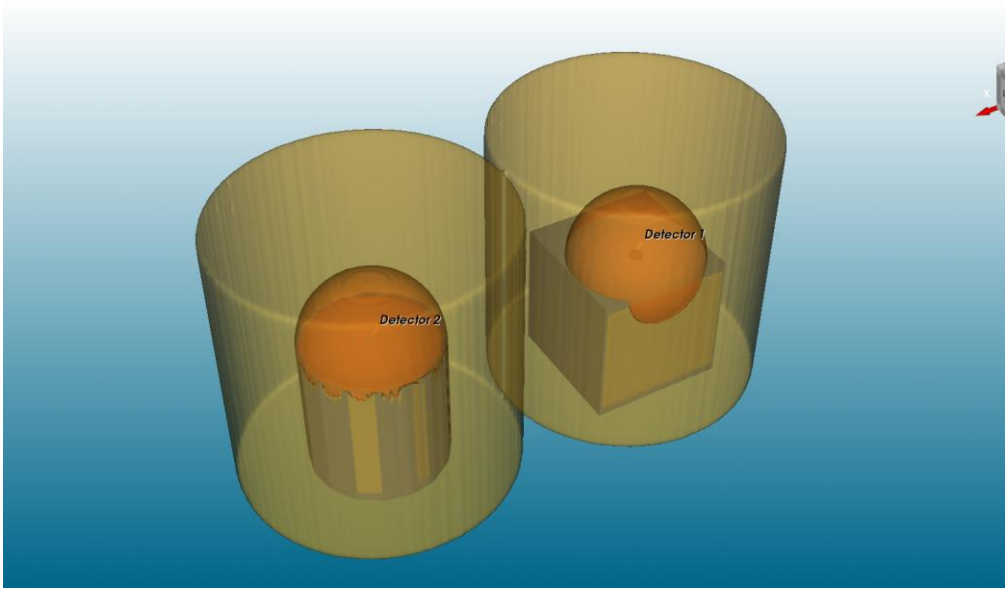
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 5 m
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 5 m

Coverage Results

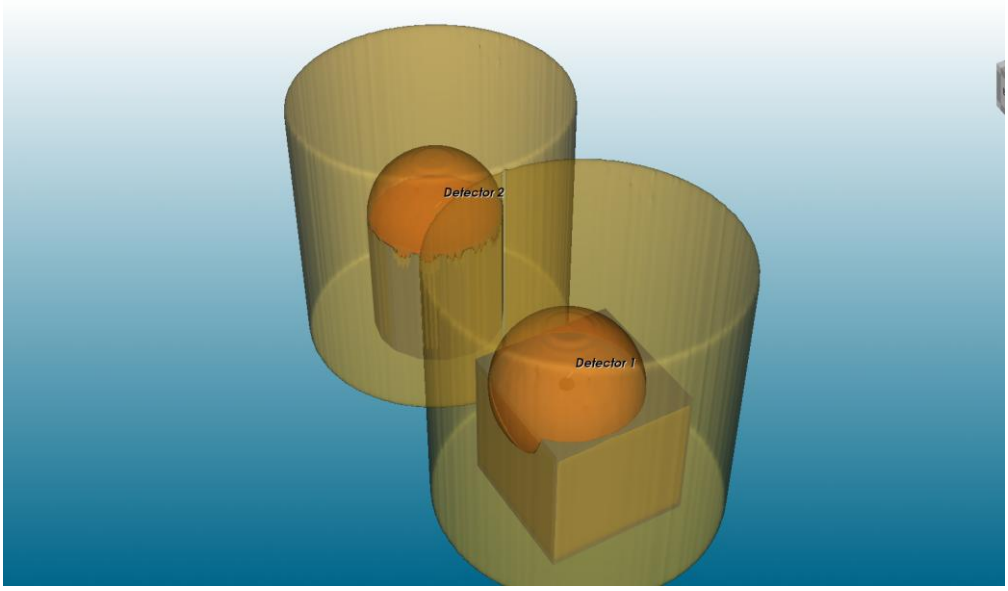
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	1ooN	L	4.86	4.93	0.07
Grade A	1ooN	H	0.61	0.6	0.01



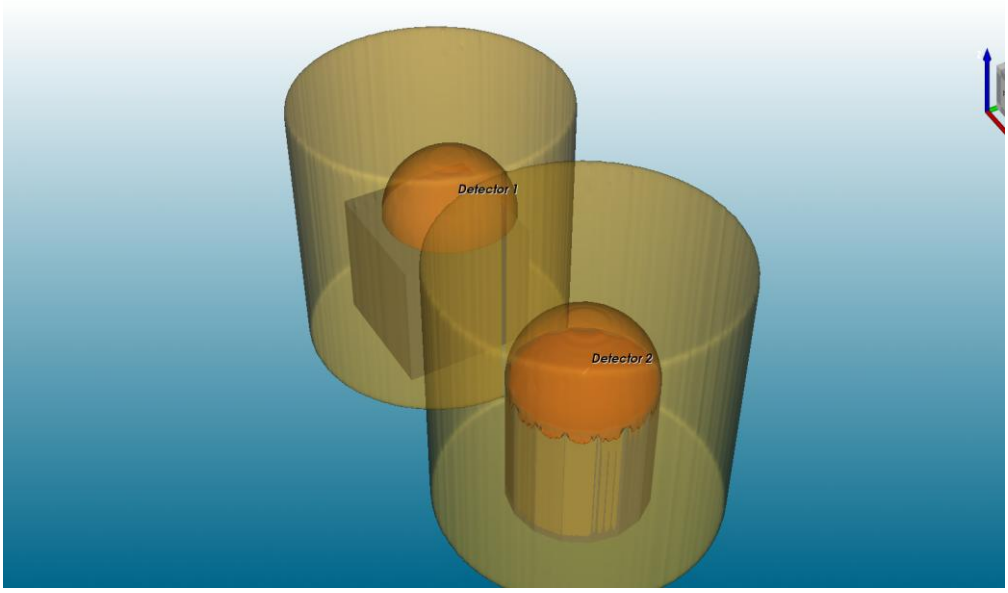
View 1 - L



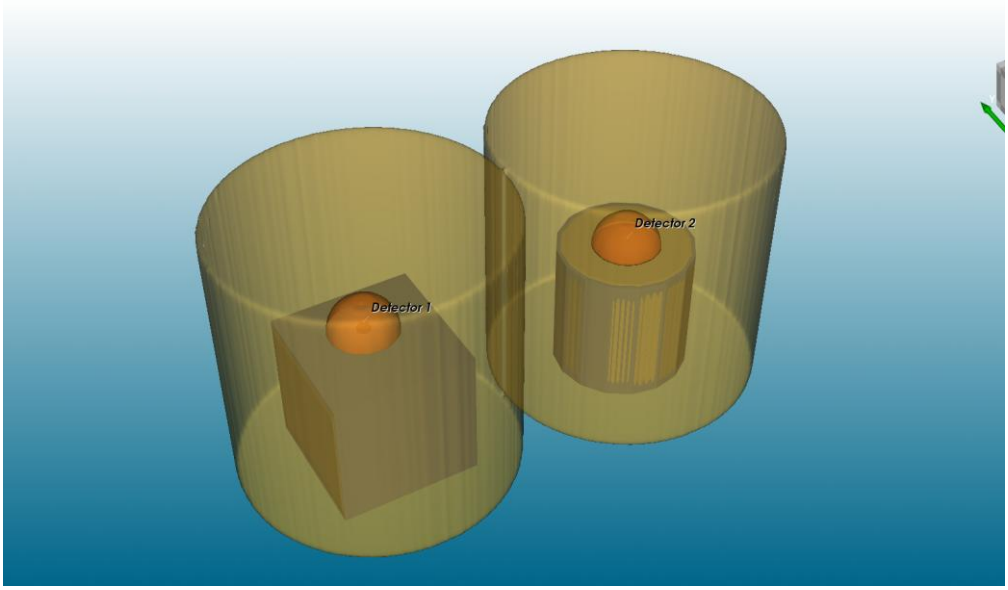
View 2 - L



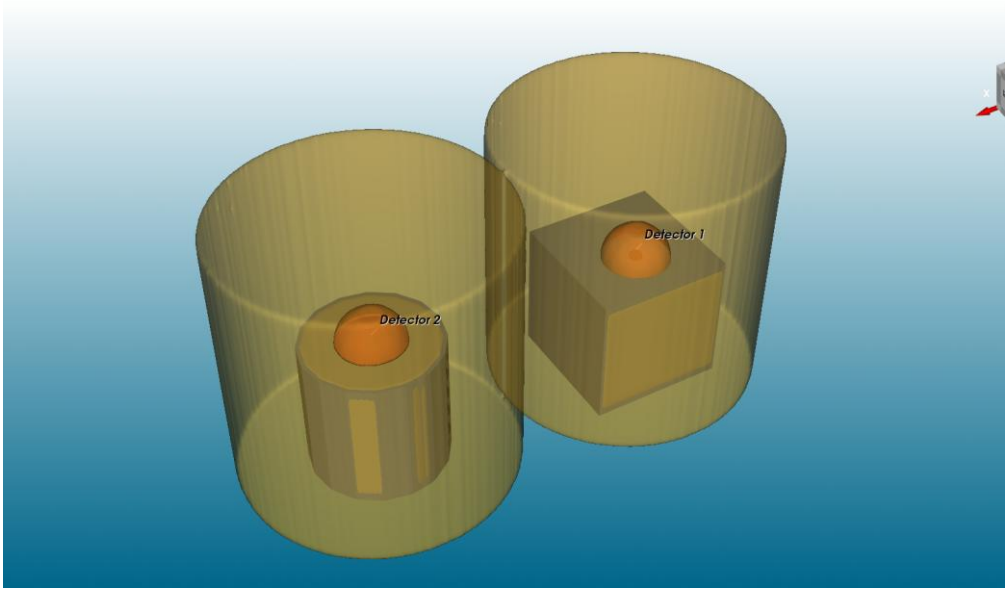
View 3 - L



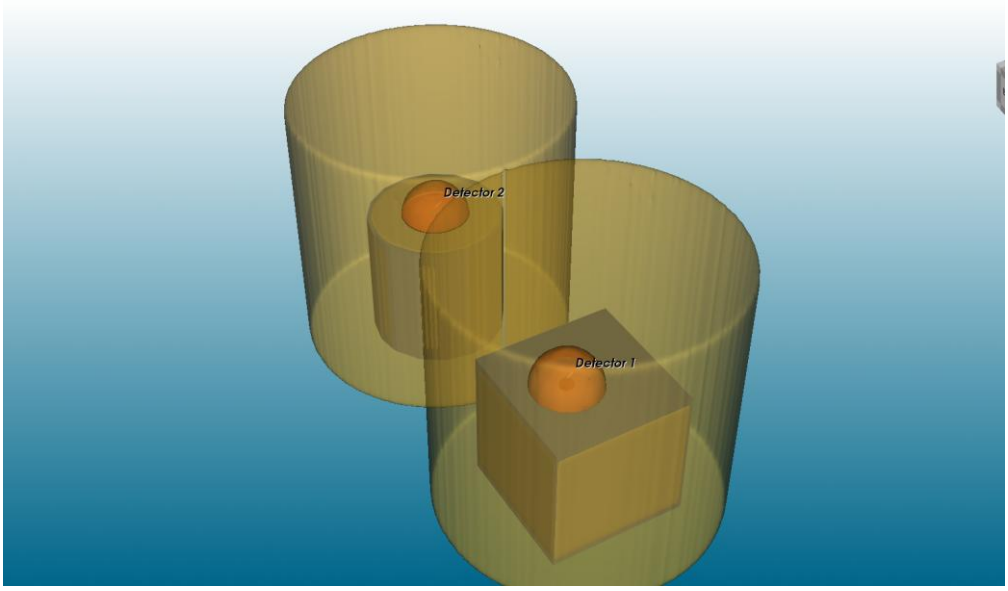
View 4 - L



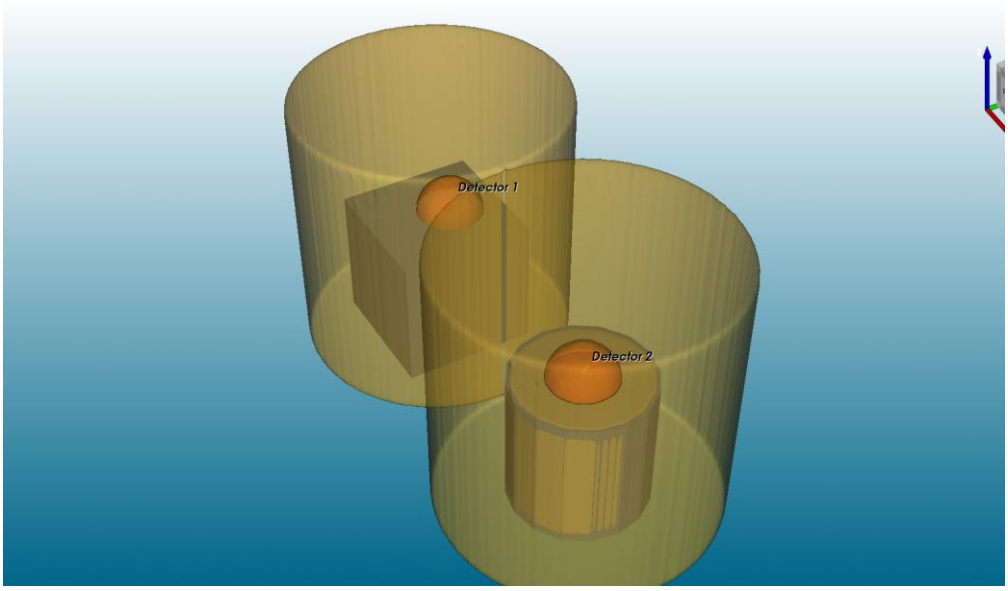
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.17 Two different types cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One PGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

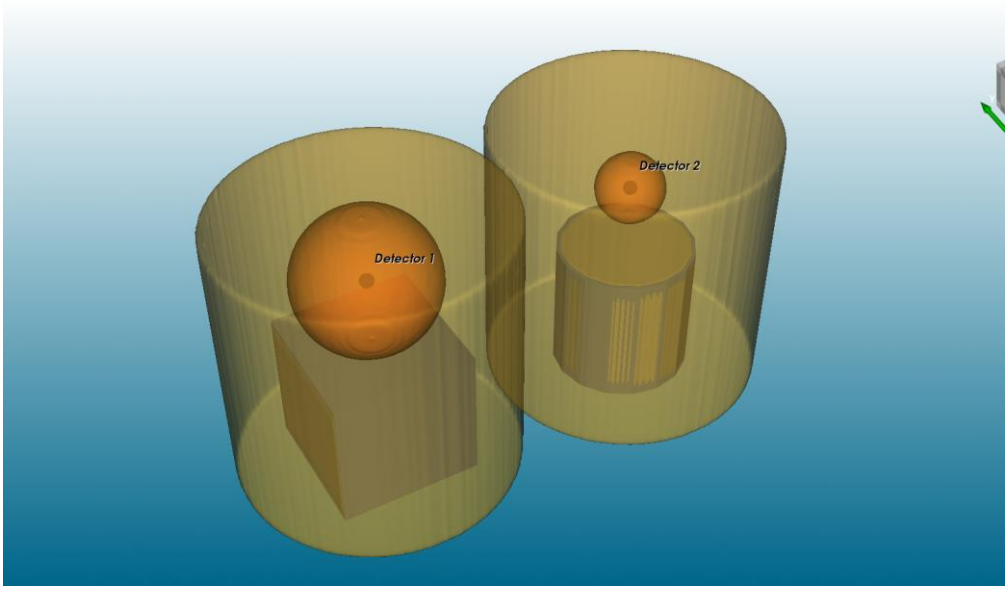
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade B
Cylinder	Radius 10 m, Height 20 m	Grade D

Gas Detectors

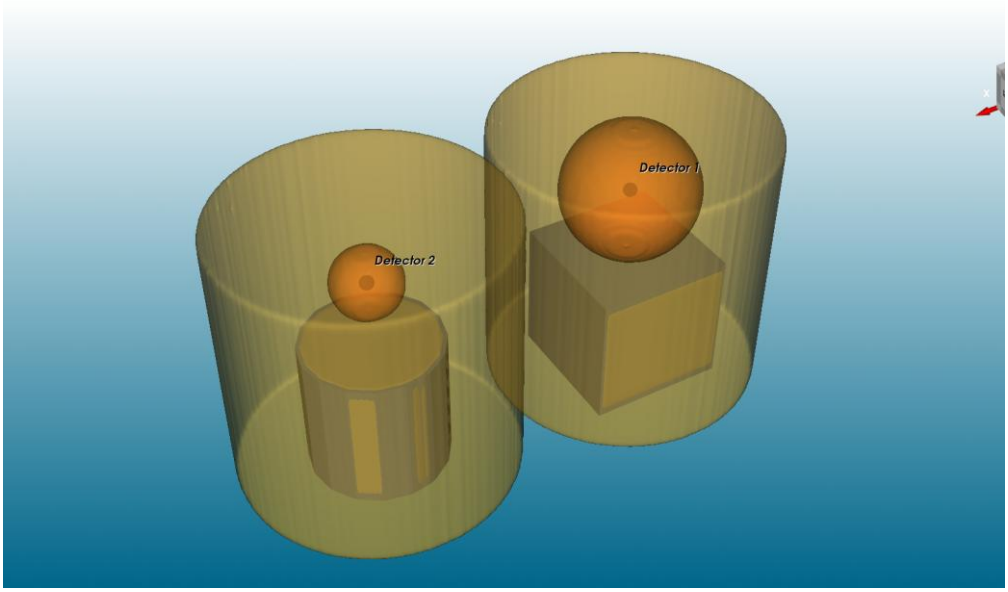
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 8 m Grade D - Low 5 m / High 4 m
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 8 m Grade D - Low 5 m / High 4 m

Coverage Results

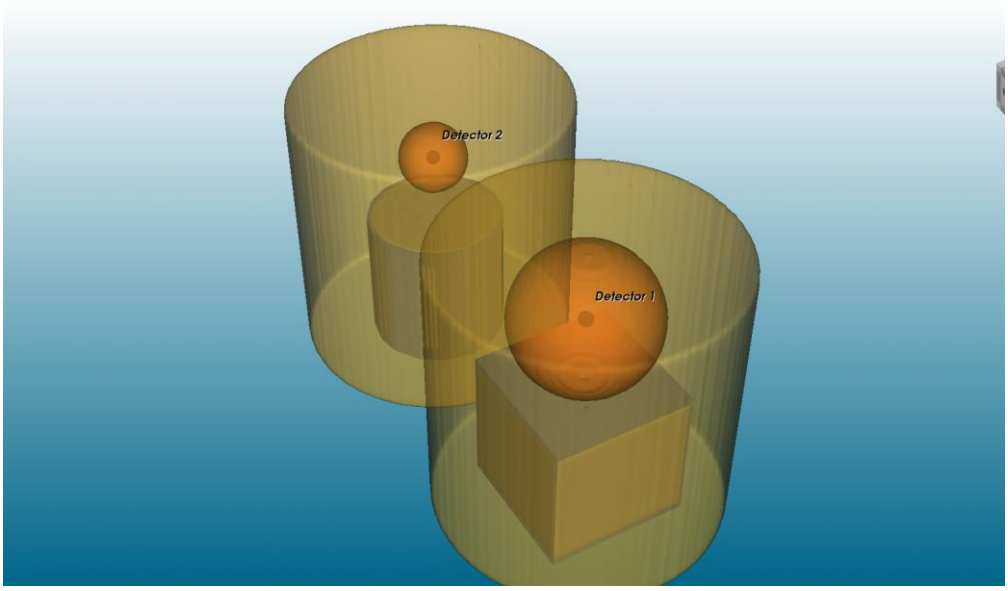
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	9.91	9.86	0.05
Grade D	1ooN	L	1.19	1.18	0.01
Grade B	1ooN	H	5.07	5.04	0.03
Grade D	1ooN	H	0.61	0.61	0.00



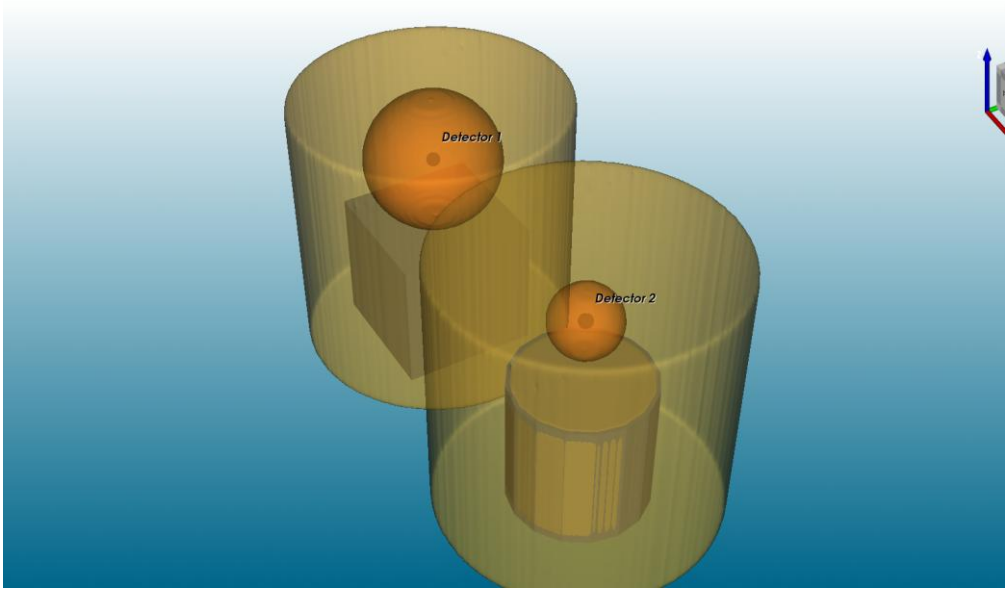
View 1 - L



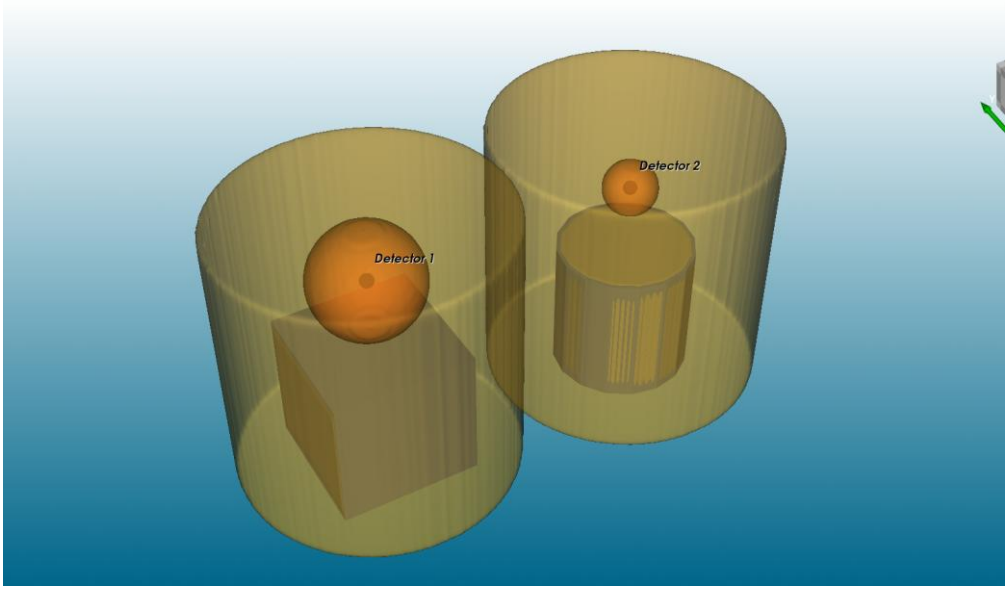
View 2 - L



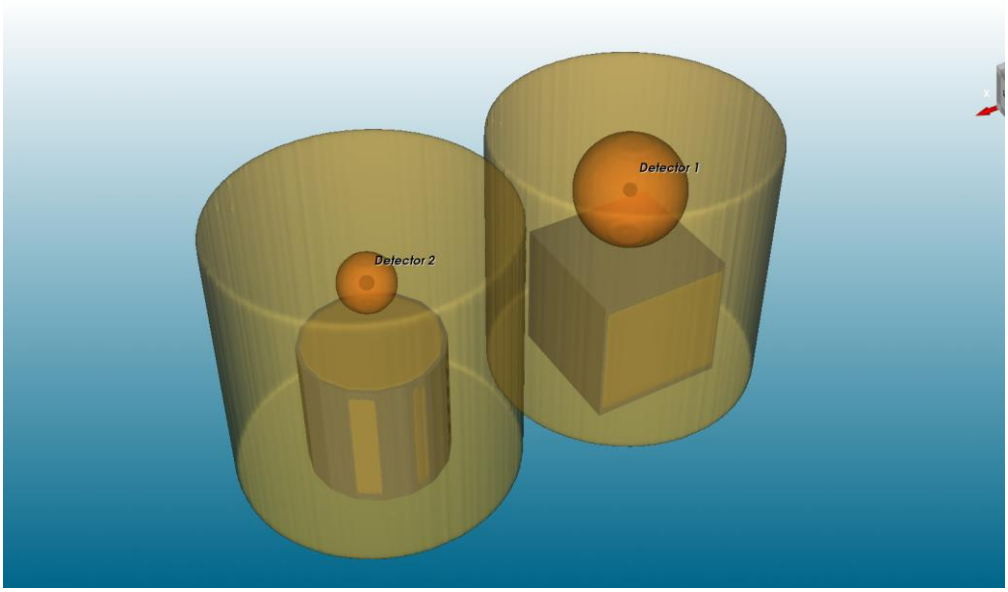
View 3 - L



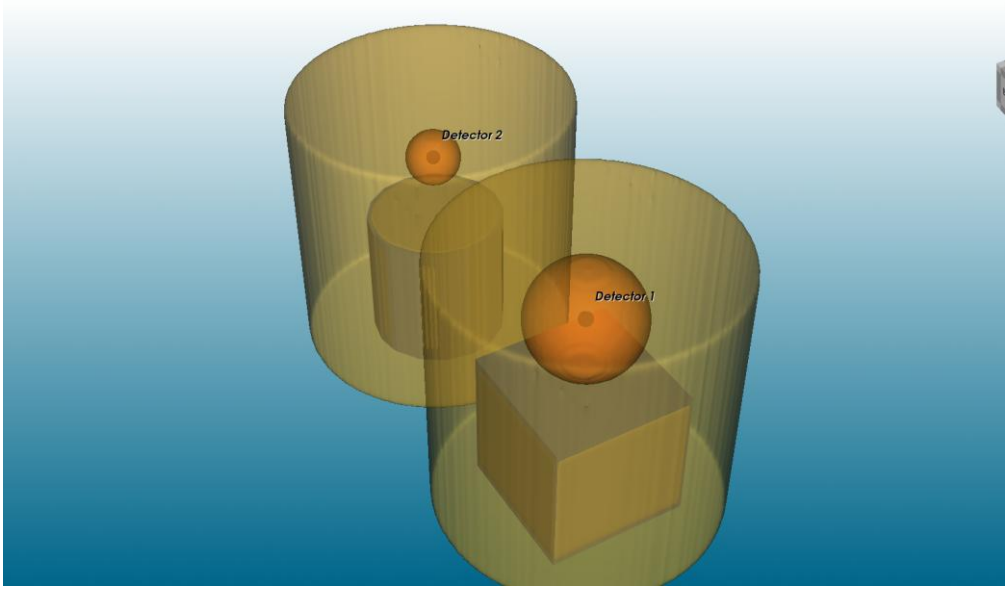
View 4 - L



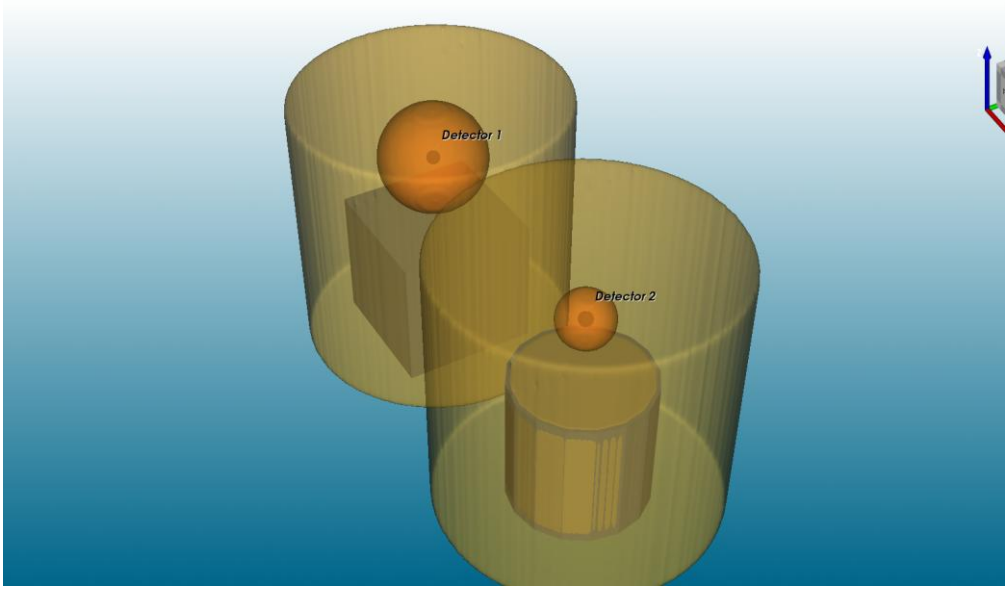
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.18 Two same type cubical grades used. One grade (Open type) surrounds a cubical gemoetry. Another grade (again open type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

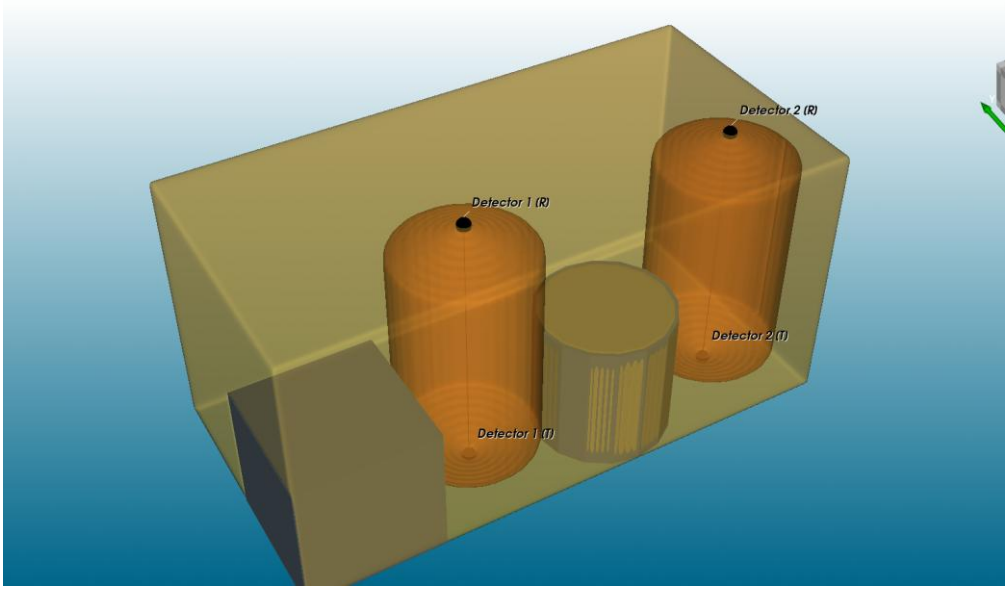
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

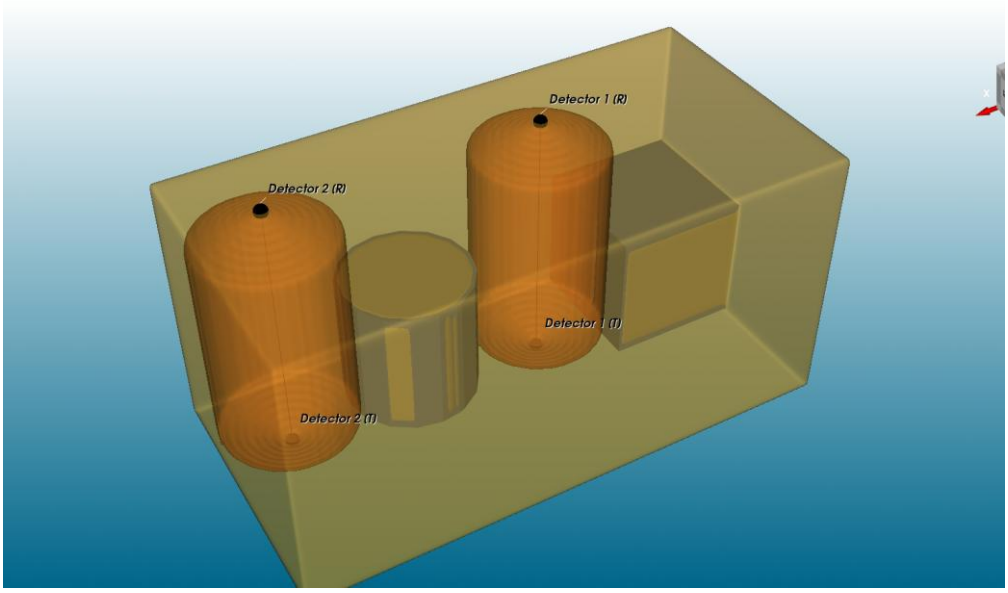
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade B - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade B - Low 10 m / High 5 m

Coverage Results

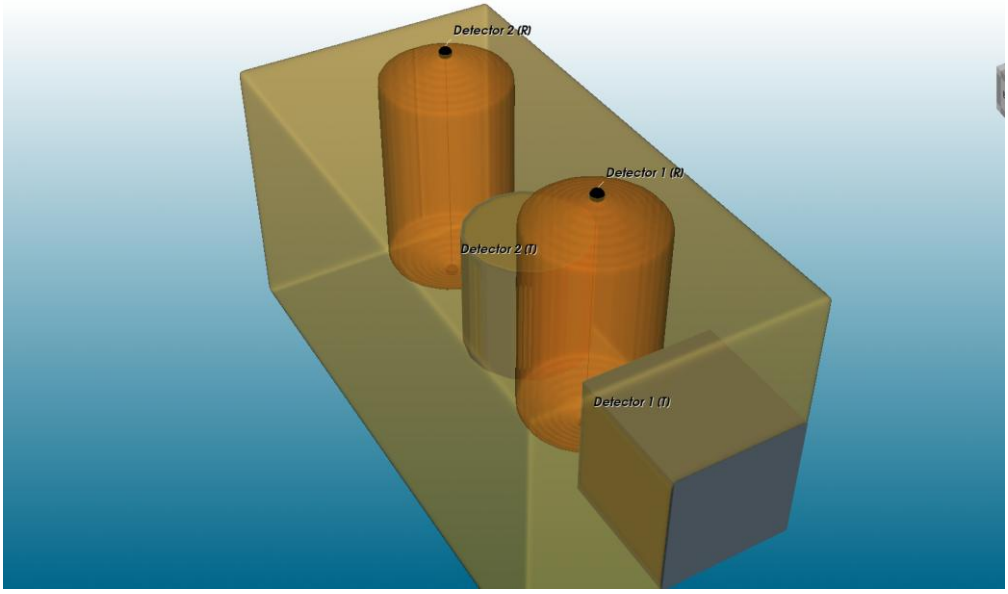
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	19.45	19.08	0.37
Grade B	1ooN	H	4.79	4.77	0.02



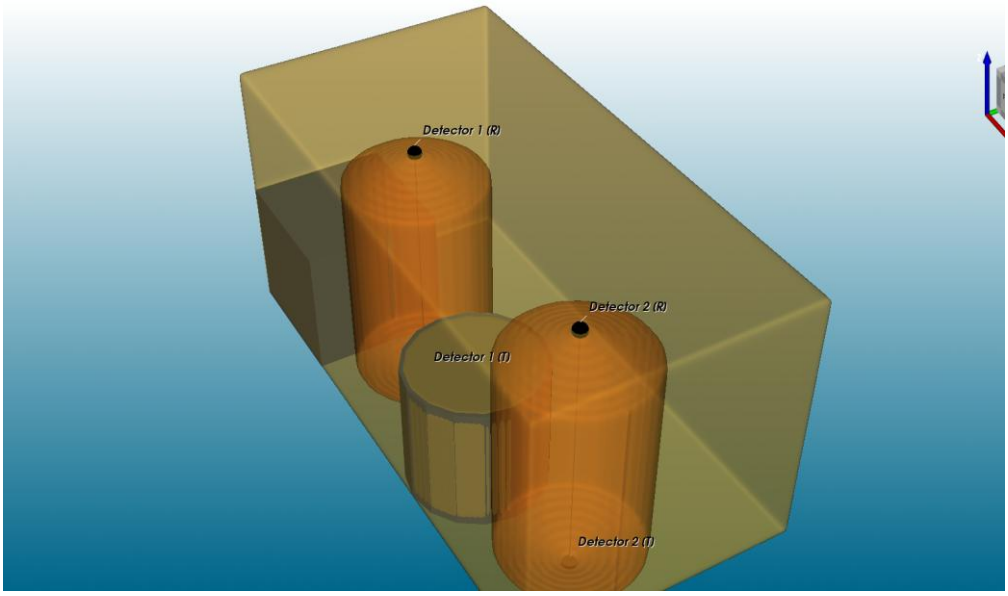
View 1 - L



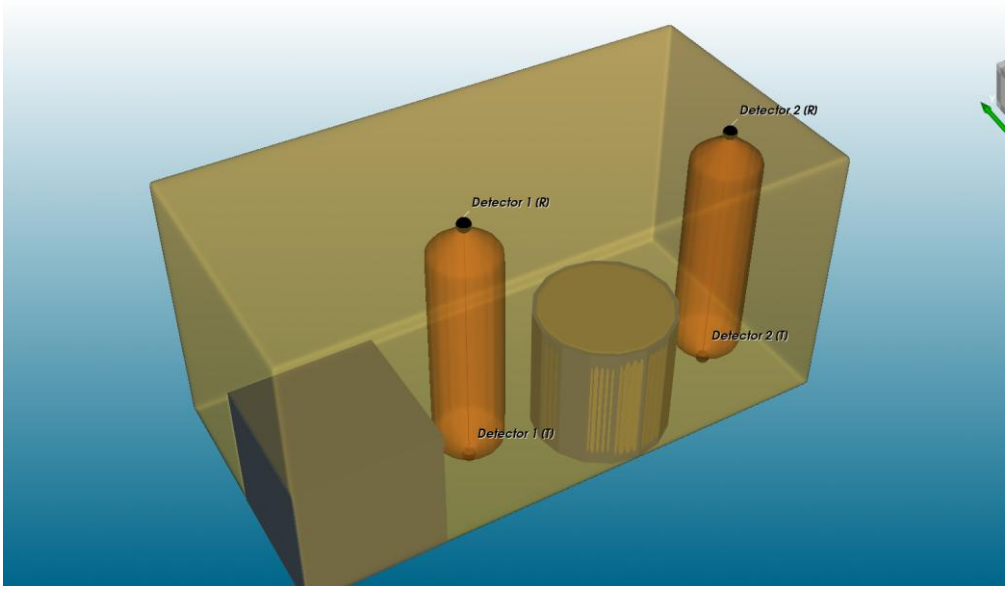
View 2 - L



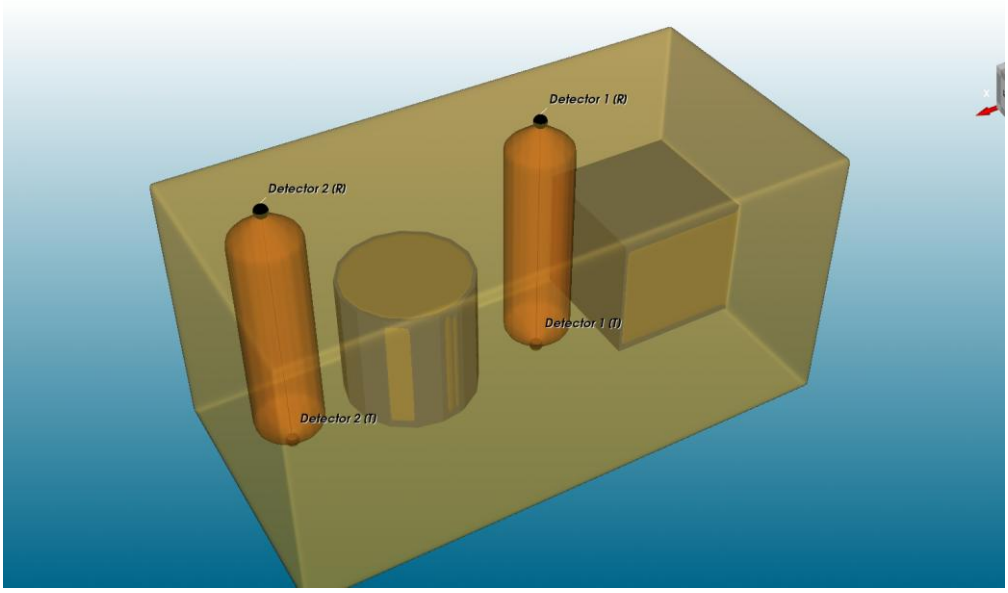
View 3 - L



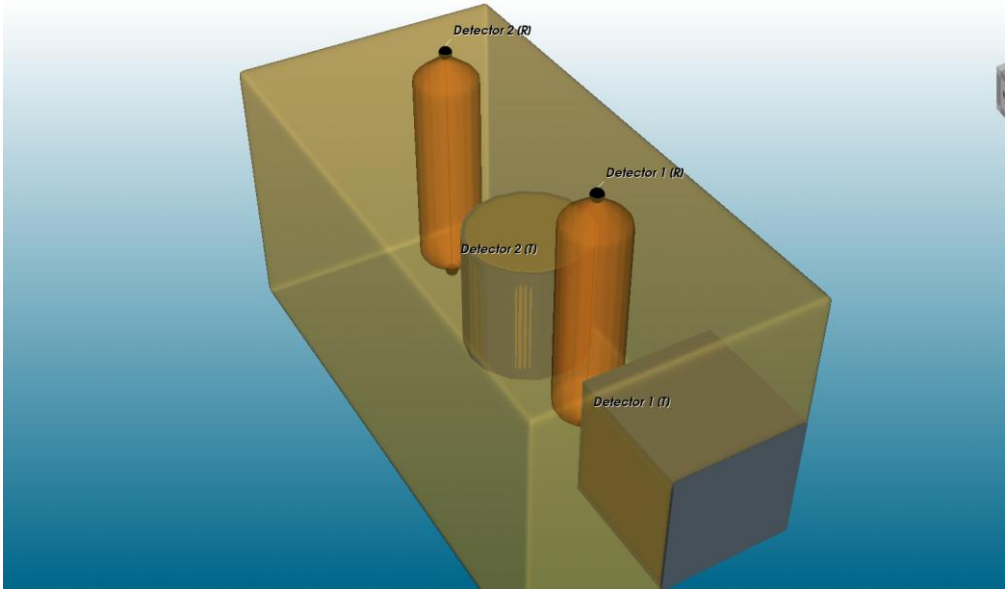
View 4 - L



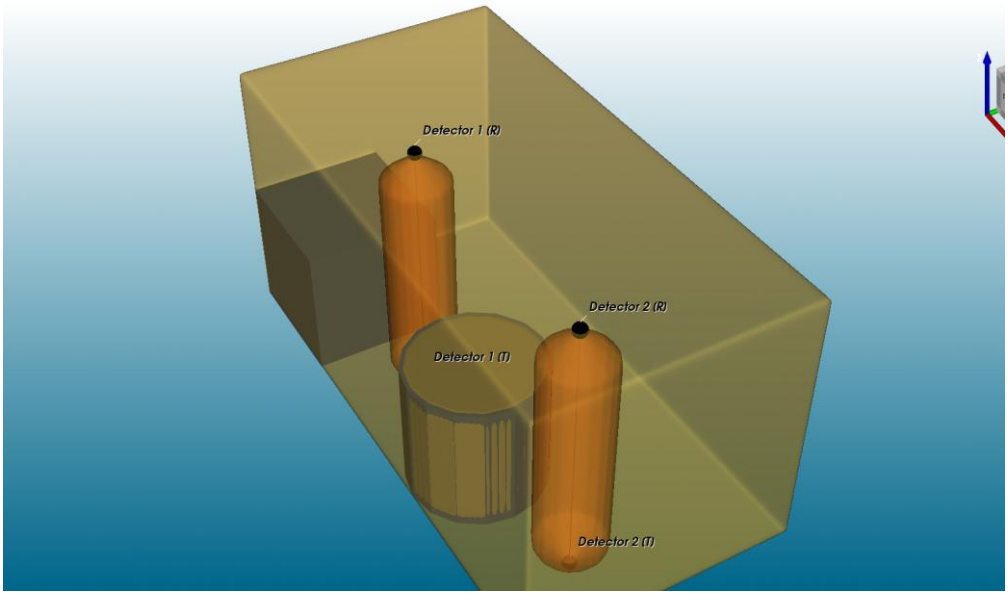
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.19 Two different types cubical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

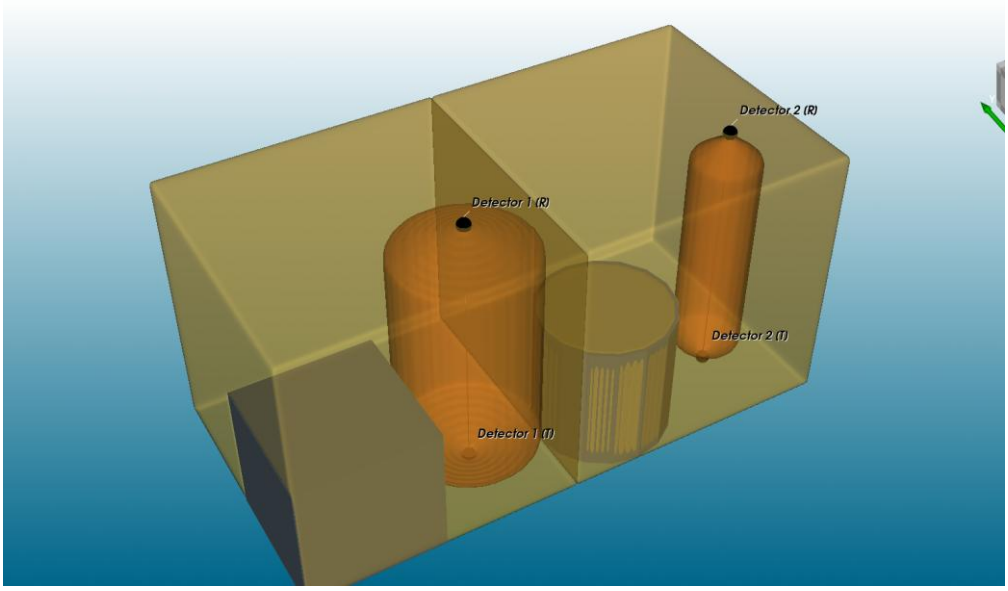
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade D
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

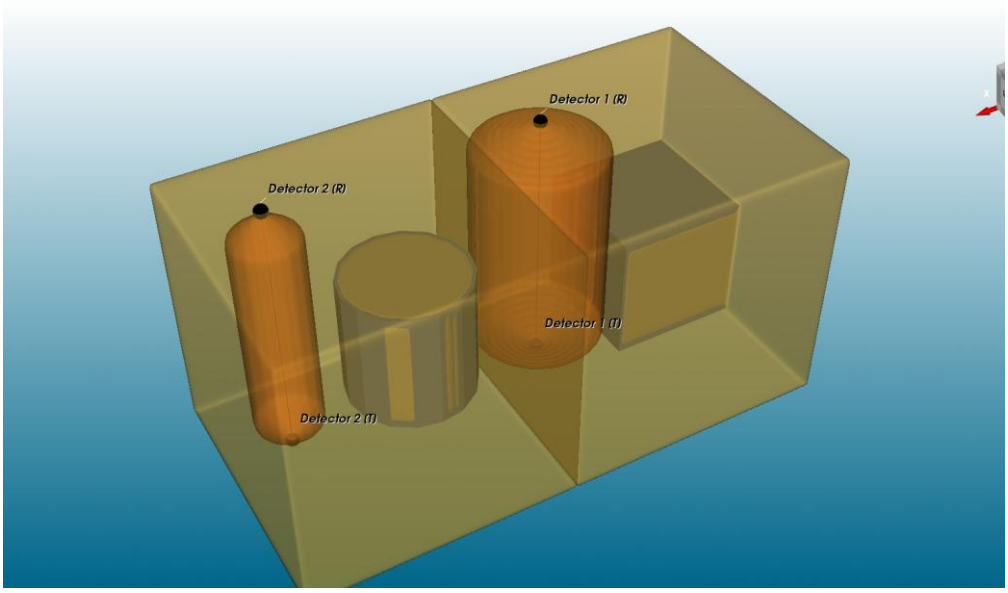
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - Low 10 m / High 5 m Grade A - Low 5 m / High 2.5 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade D - Low 10 m / High 5 m Grade A - Low 5 m / High 2.5 m

Coverage Results

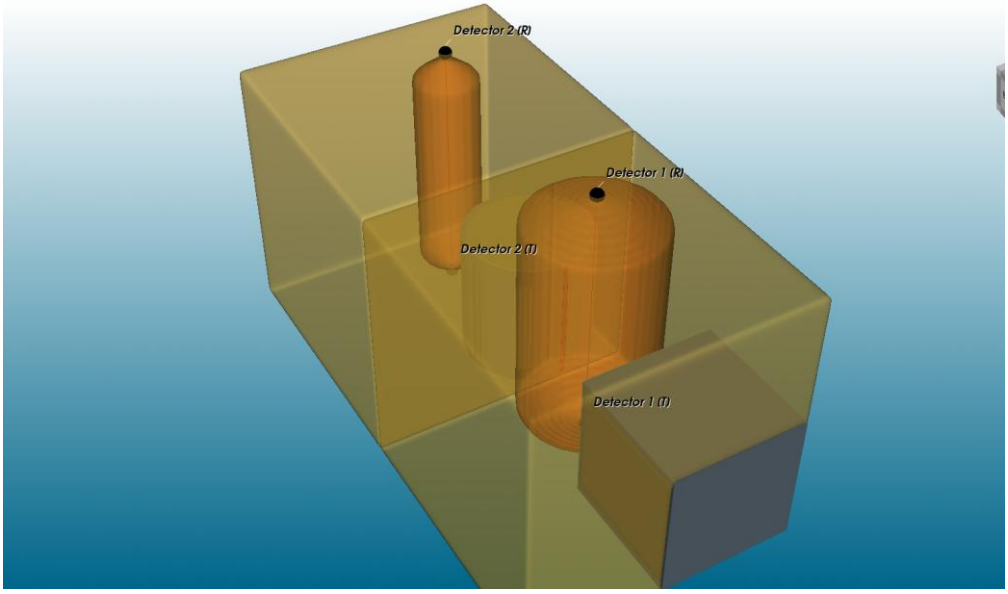
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade D	1ooN	L	19.45	19.35	0.10
Grade A	1ooN	L	4.72	4.7	0.02
Grade D	1ooN	H	4.86	4.84	0.02
Grade A	1ooN	H	1.18	1.17	0.01



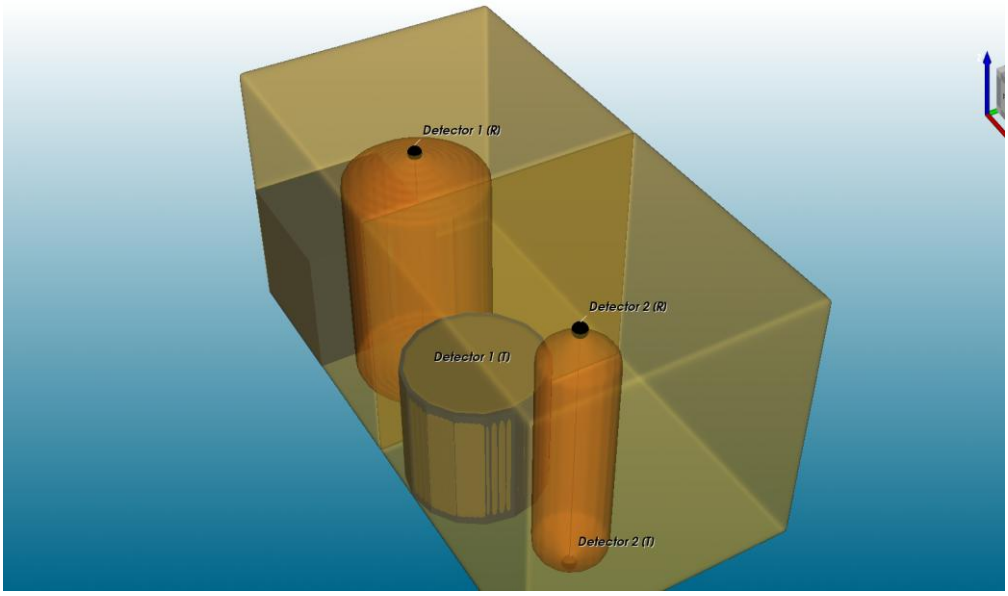
View 1 - L



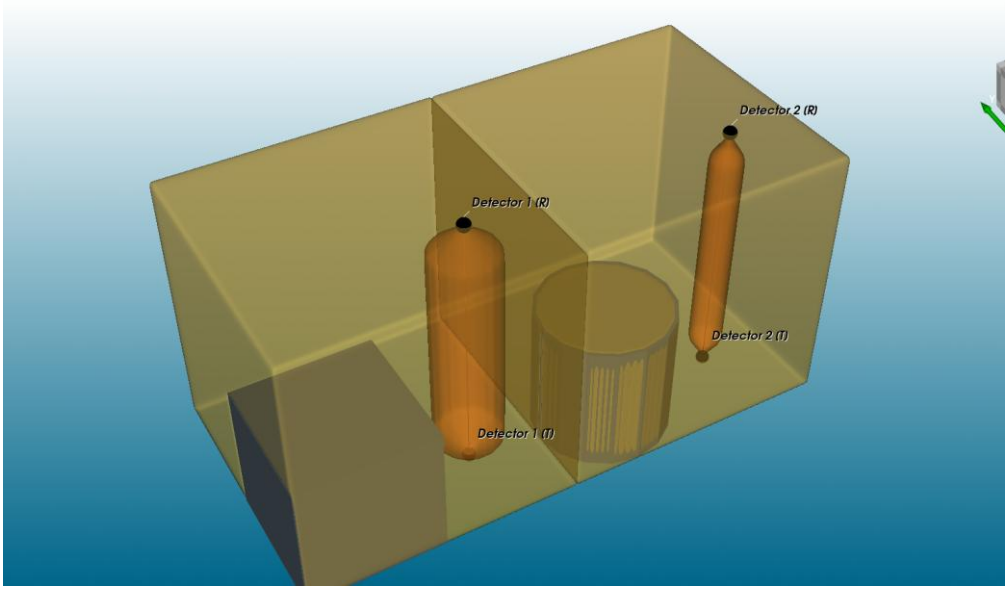
View 2 - L



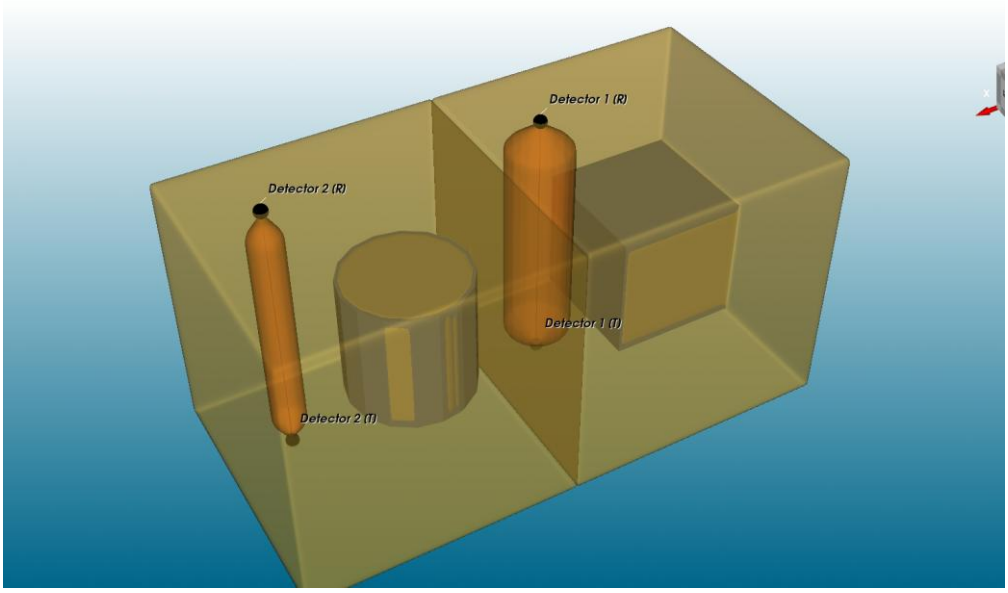
View 3 - L



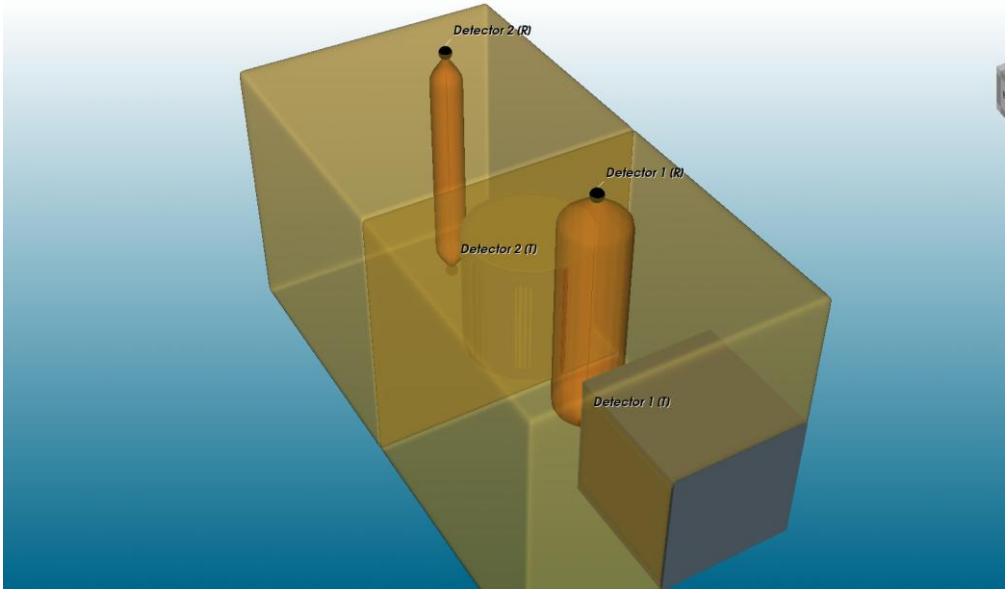
View 4 - L



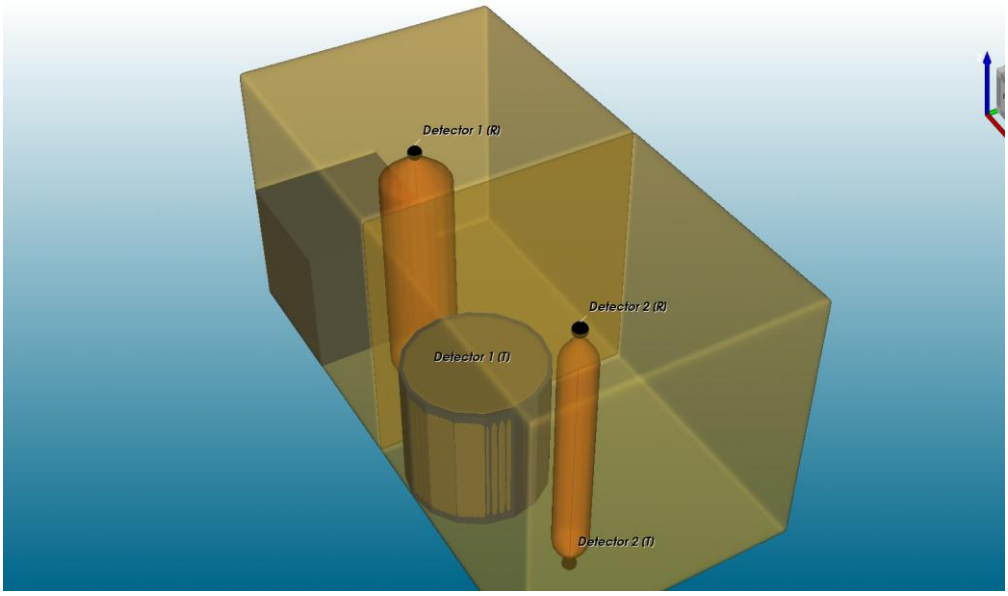
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.20 Two same type cylindrical grades used. One grade (Open type) surrounds a cubical gemoetry. Another grade (again open type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

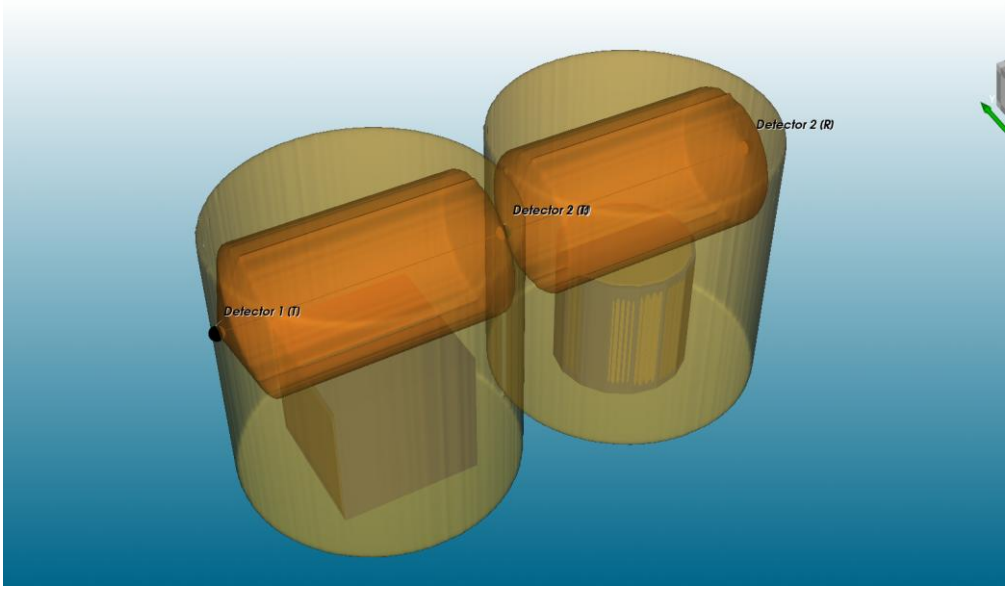
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade C
Cylinder	Radius 10 m, Height 20 m	Grade C

Gas Detectors

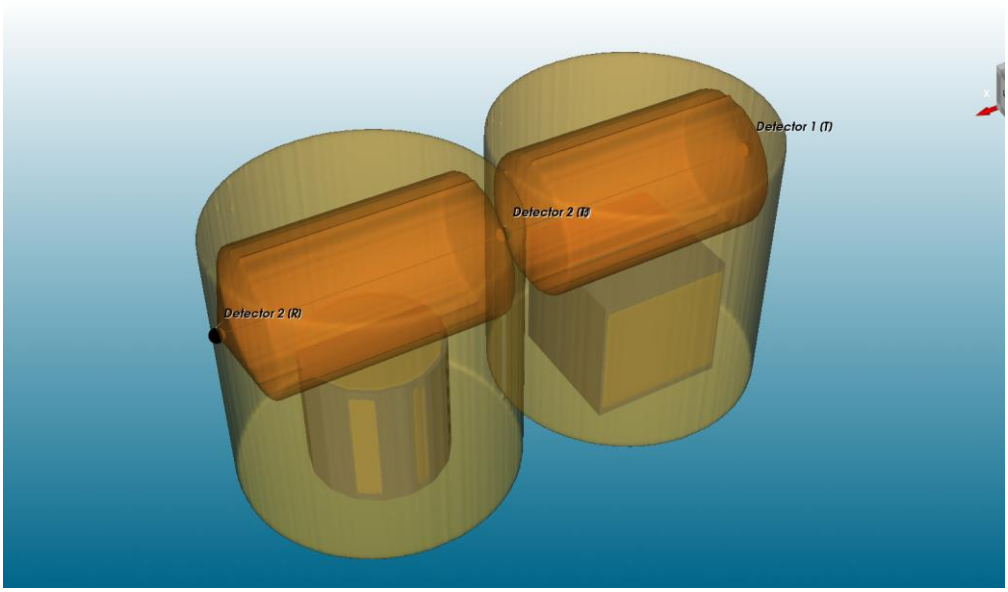
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 5 m

Coverage Results

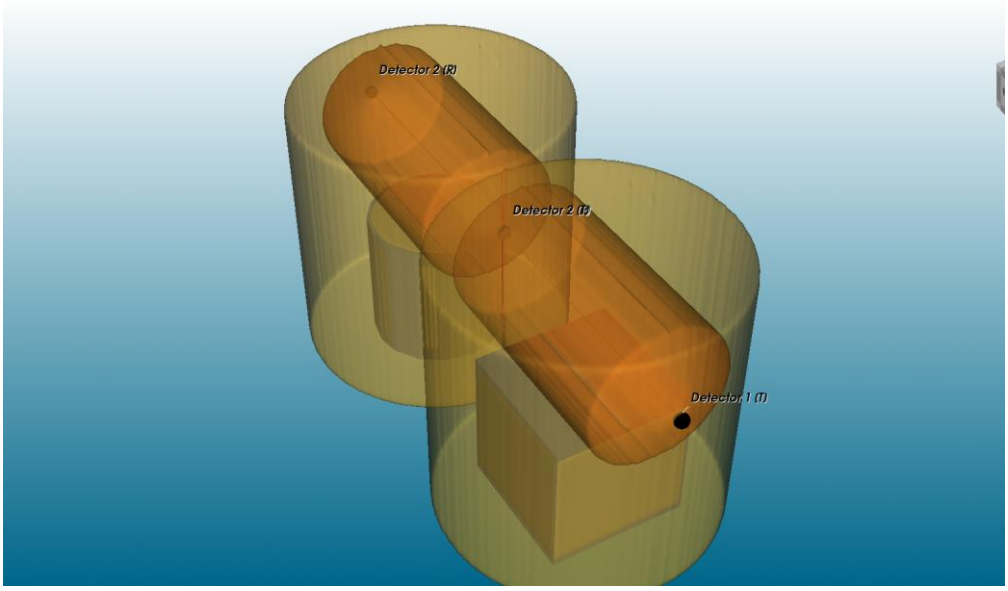
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	25.25	25.05	0.20
Grade C	1ooN	H	6.31	6.22	0.09



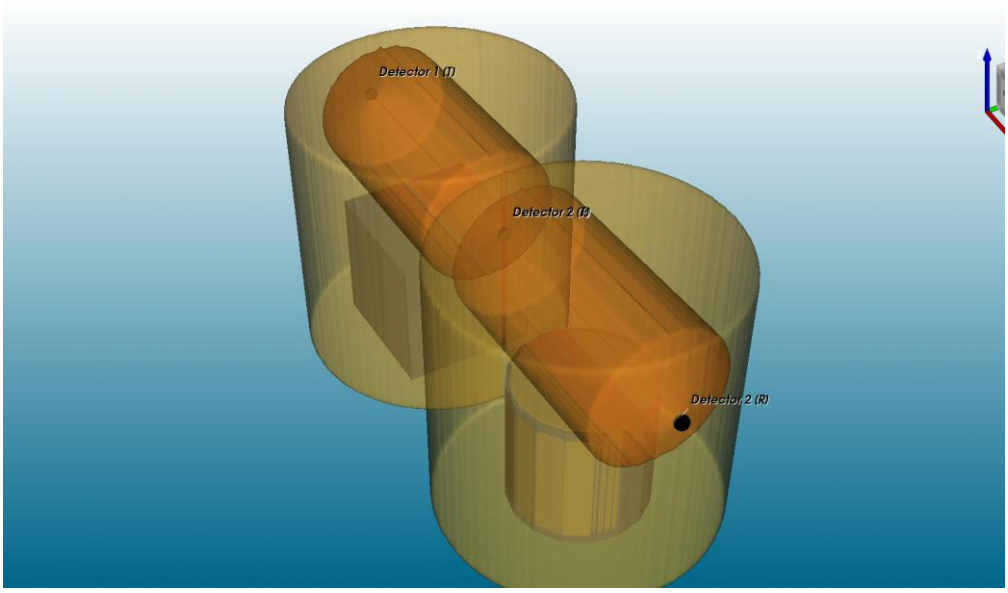
View 1 - L



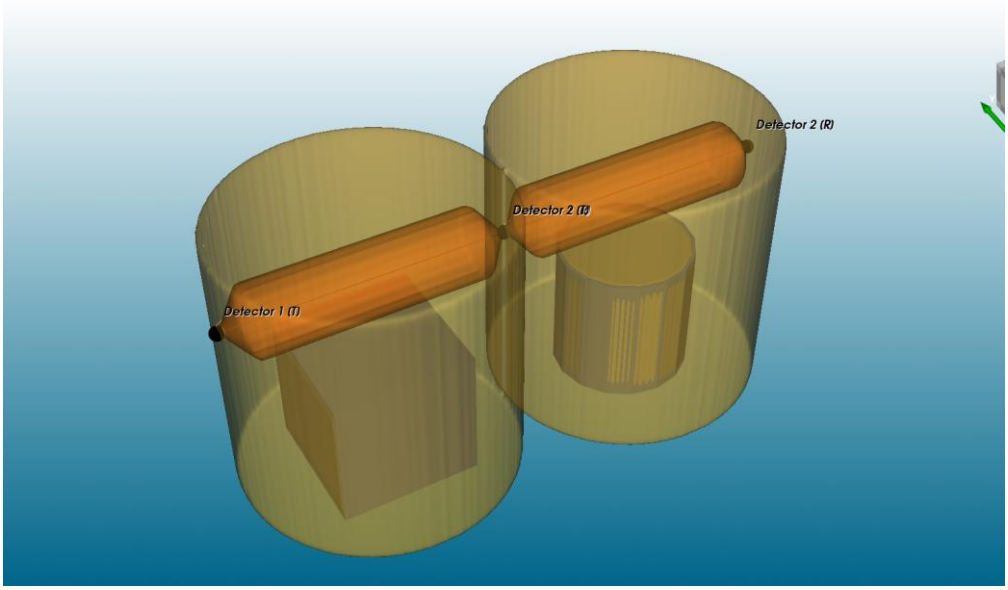
View 2 - L



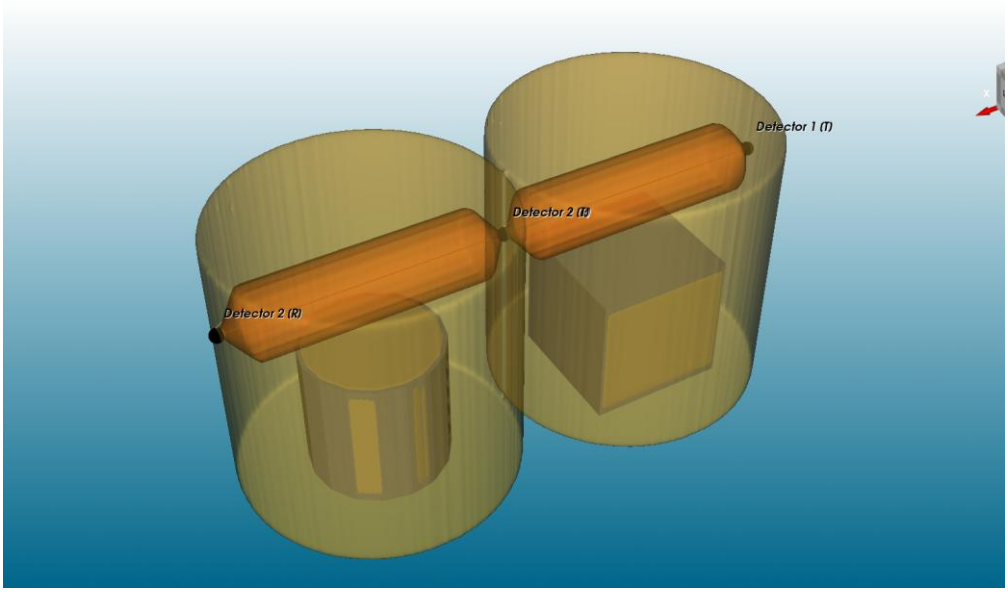
View 3 - L



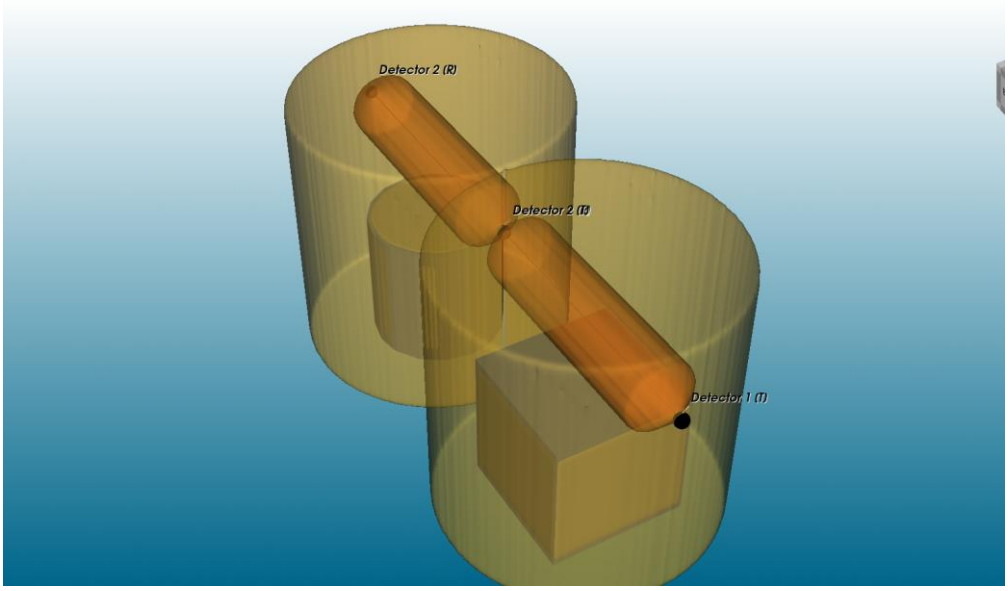
View 4 - L



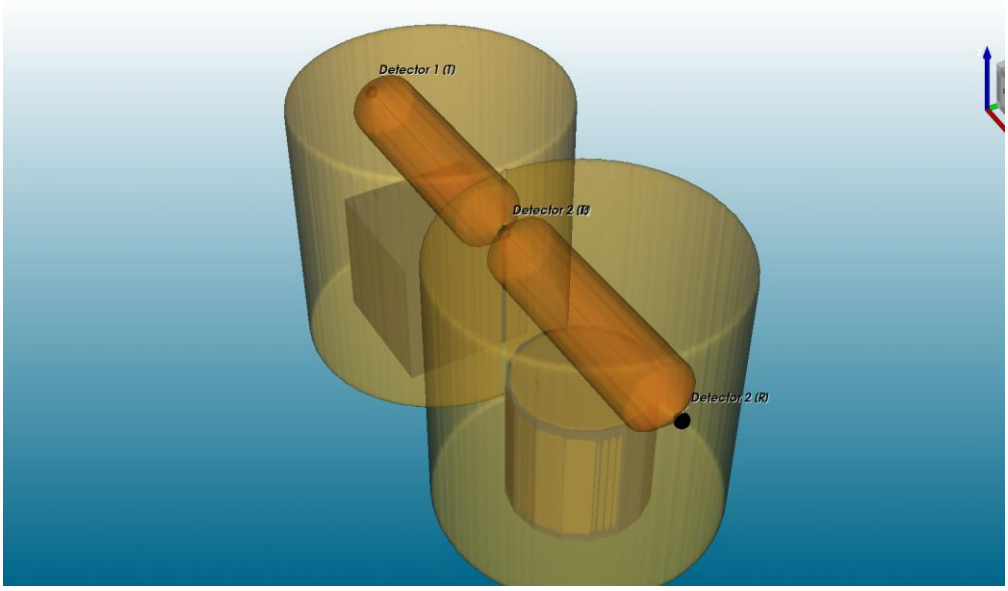
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.5.21 Two different types cylindrical grades used. One grade (Open type) surrounds a cubical geometry. Another grade (Partial type) surrounds a cylindrical geometry. One OPGD with its FOI completely inside each grade but outside the geometry. Geometry volumes are discounted from coverage calculation.

Risk Grades

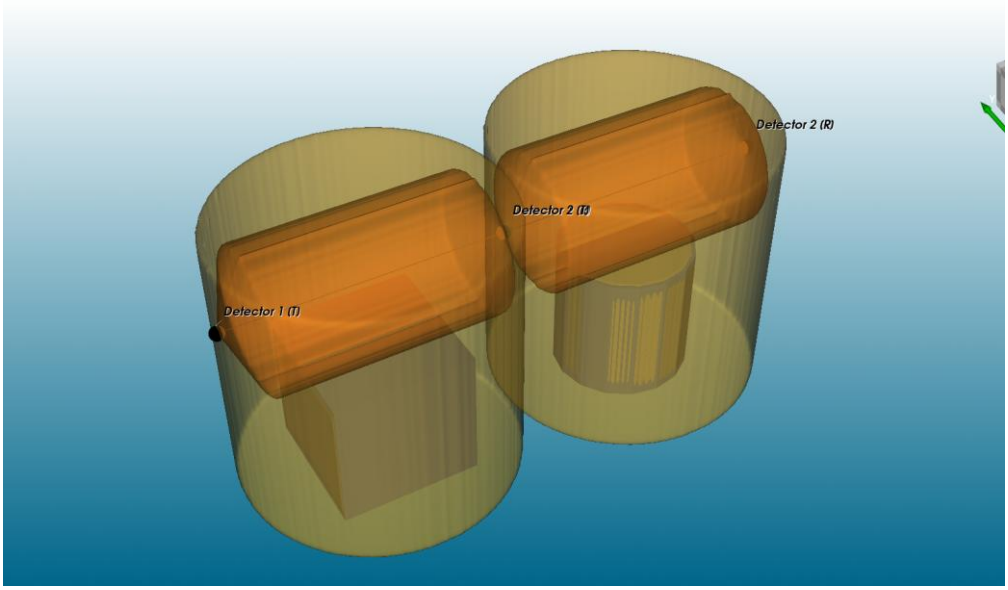
Risk Grade Geometry	Dimensions	Risk Grade Type
Cylinder	Radius 10 m, Height 20 m	Grade C
Cylinder	Radius 10 m, Height 20 m	Grade B

Gas Detectors

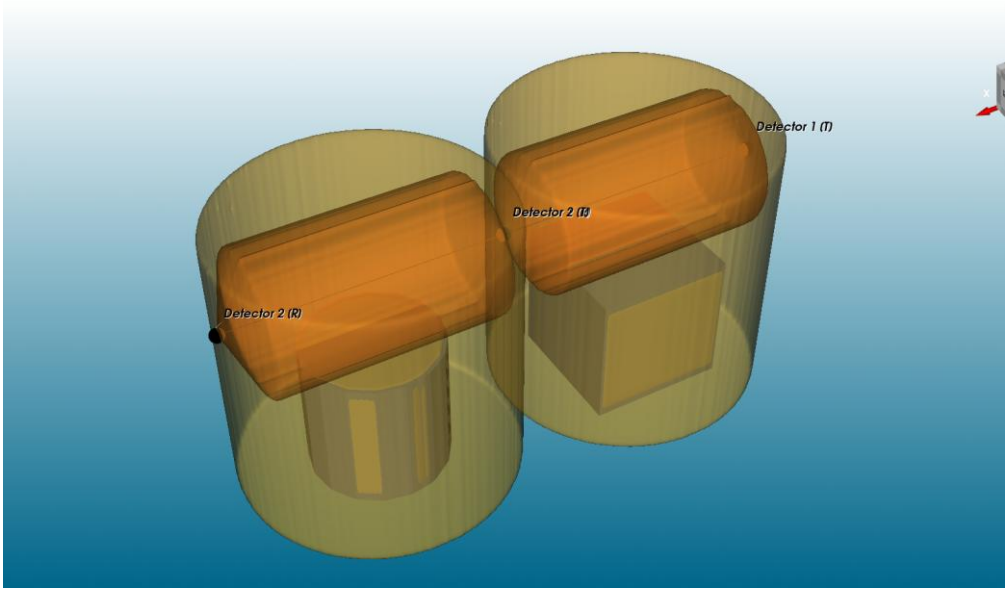
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 5 m Grade B - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 5 m Grade B - Low 10 m / High 5 m

Coverage Results

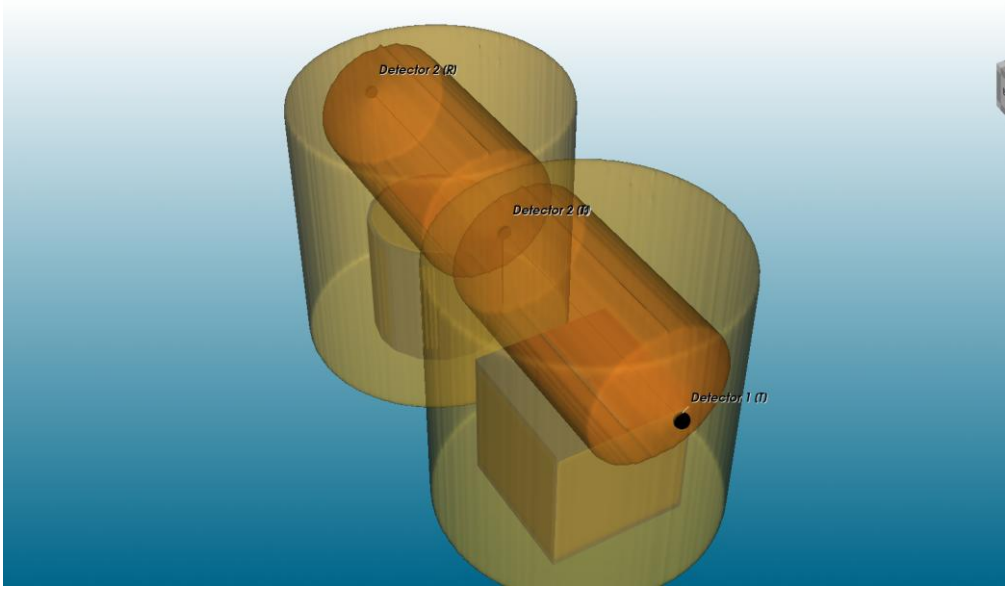
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	25.77	25.54	0.23
Grade B	1ooN	L	25	24.57	0.43
Grade C	1ooN	H	6.44	6.34	0.10
Grade B	1ooN	H	6.19	6.1	0.09



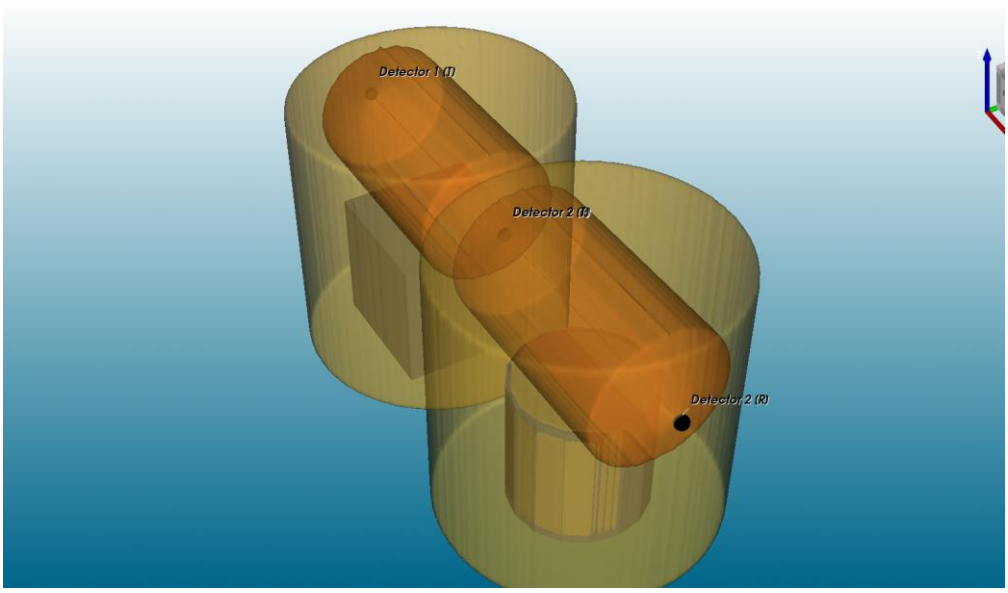
View 1 - L



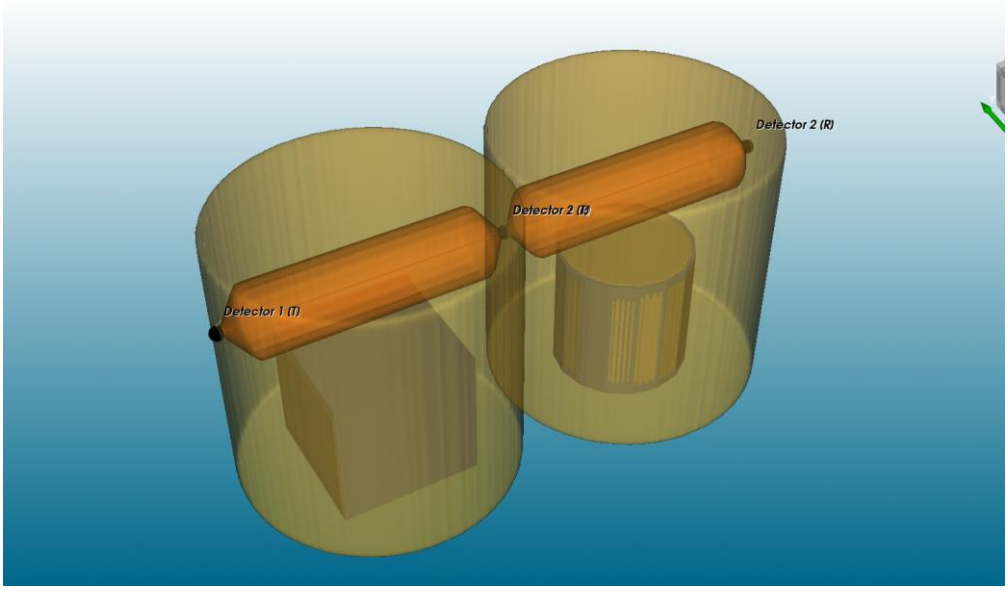
View 2 - L



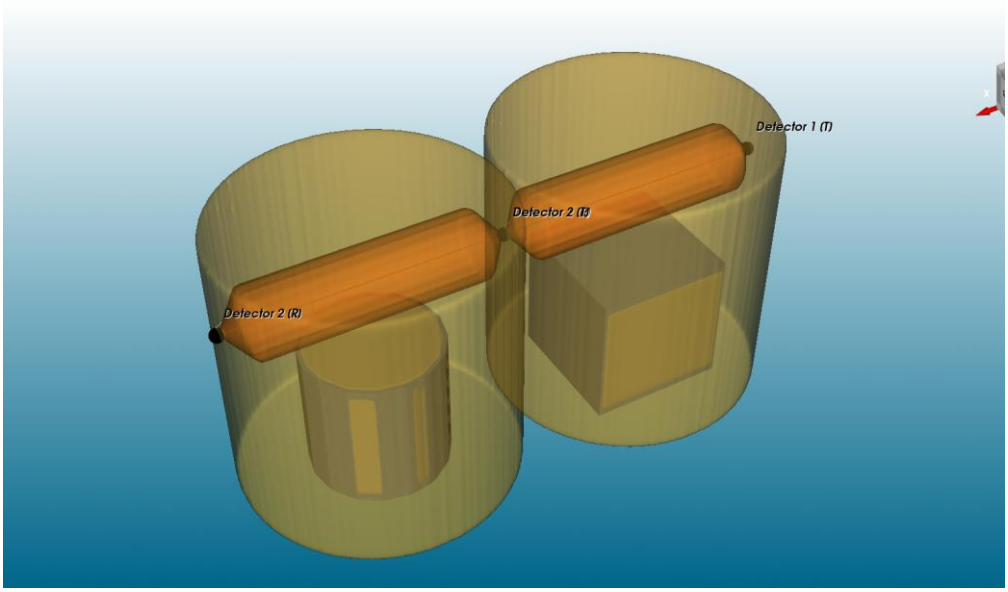
View 3 - L



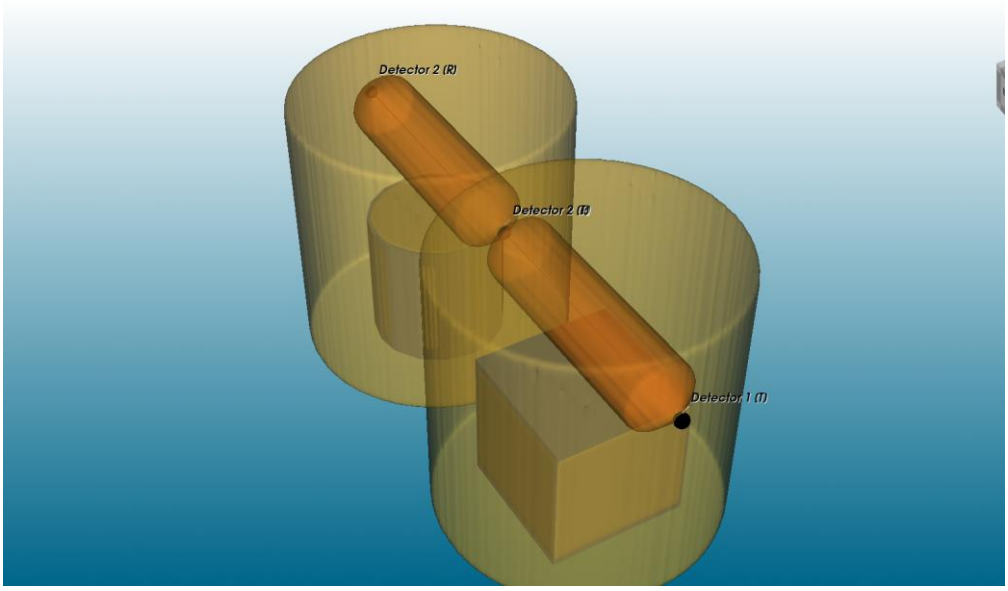
View 4 - L



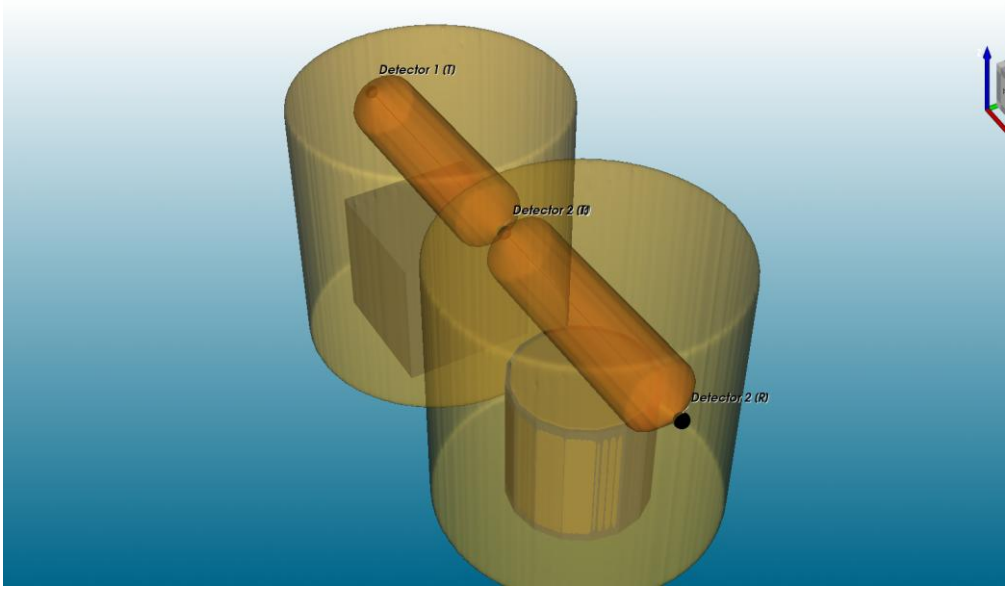
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.6 Cross Credit Validation with Geometry

6.6.1 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade but outside the geometry.

Risk Grades

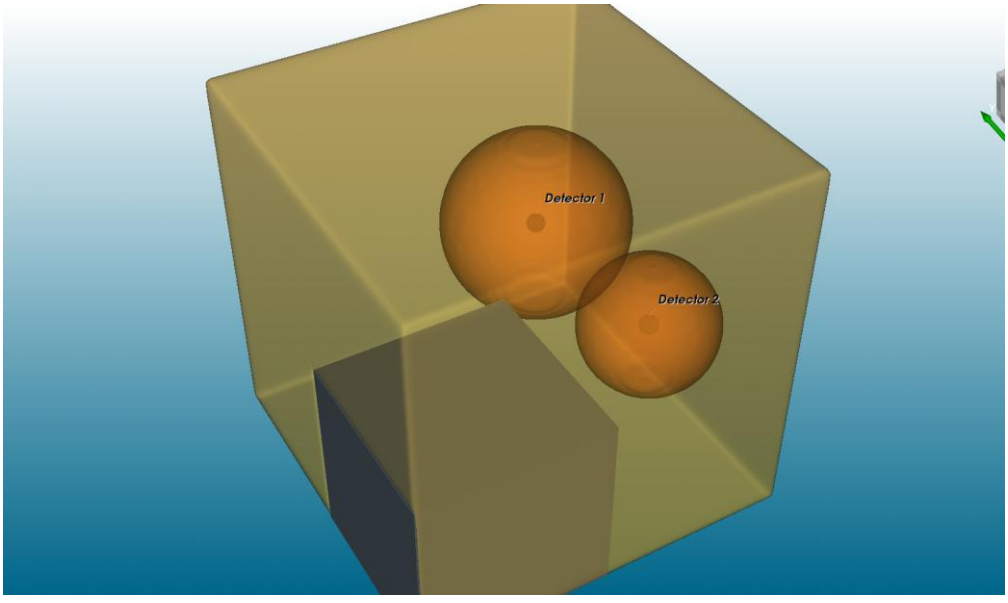
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

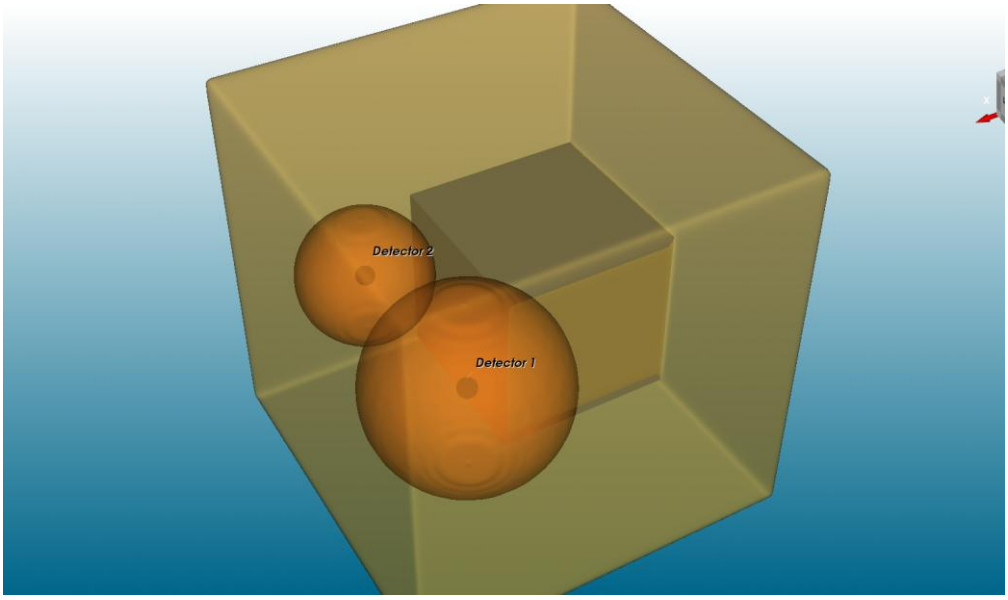
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2S	Grade B - Low 7 m / High 4 m

Coverage Results

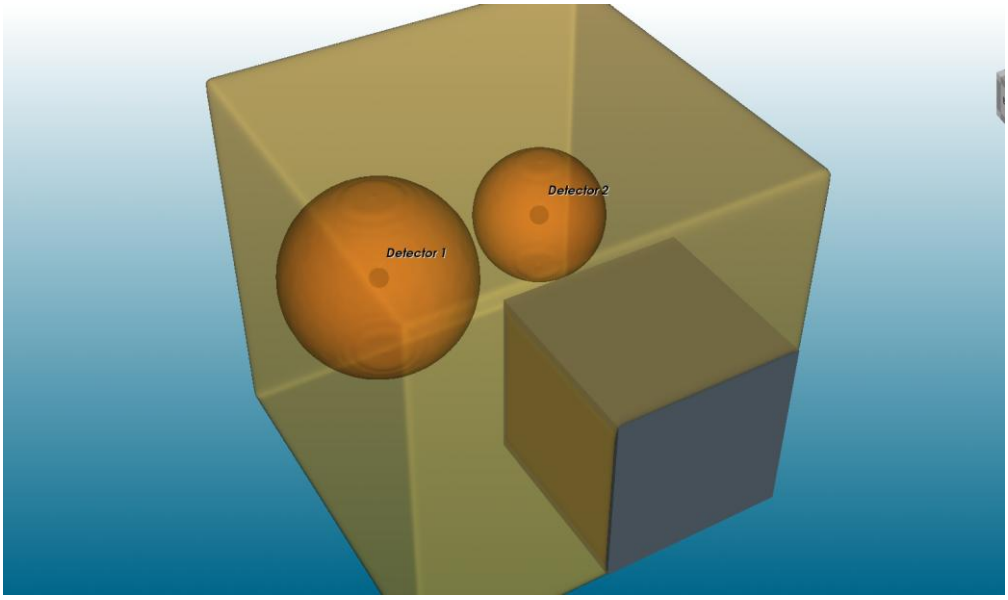
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	10.05	9.99	0.06
Grade B	1ooN	H	1.41	1.4	0.01



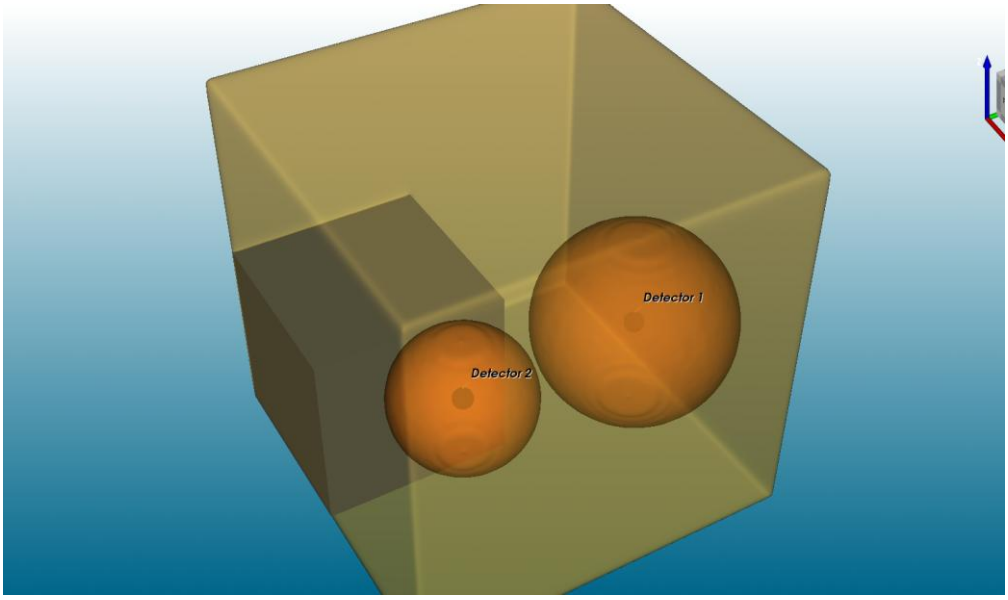
View 1 - L



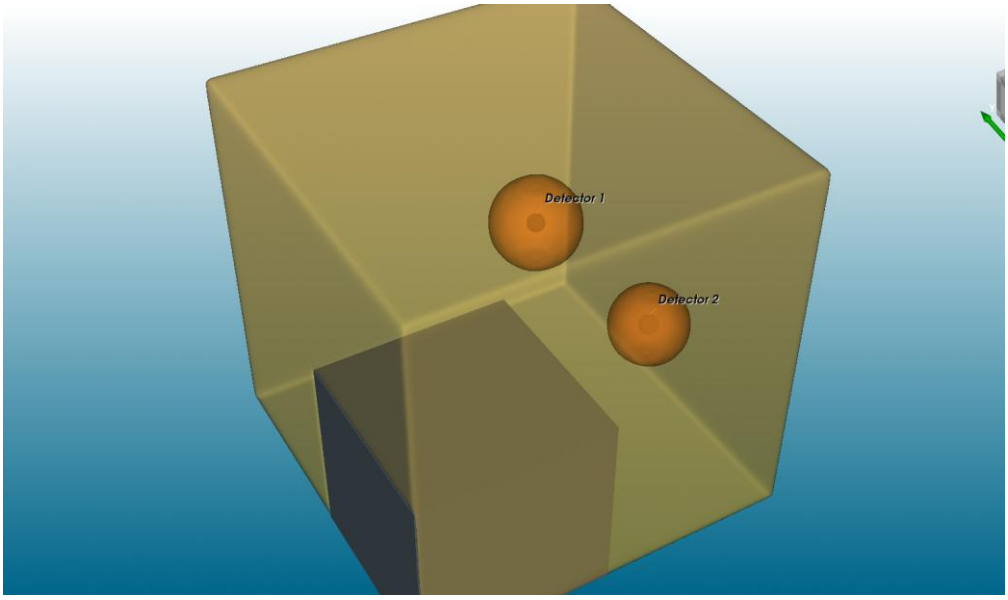
View 2 - L



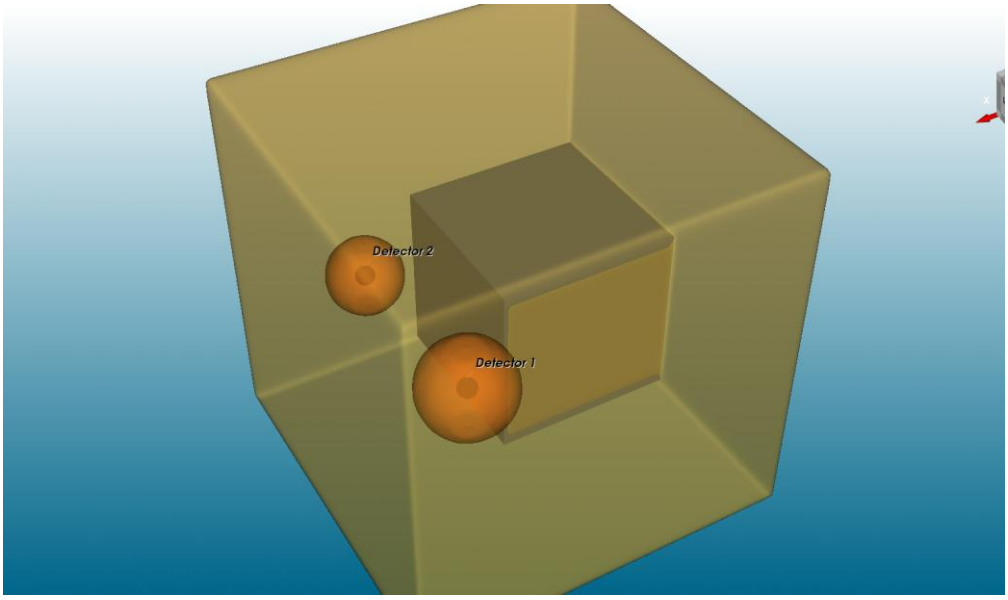
View 3 - L



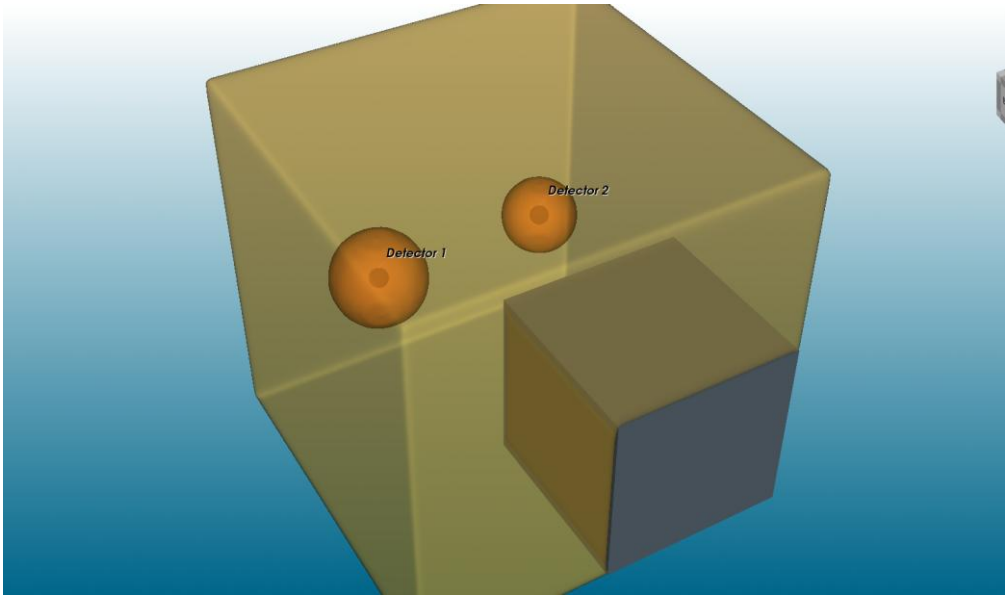
View 4 - L



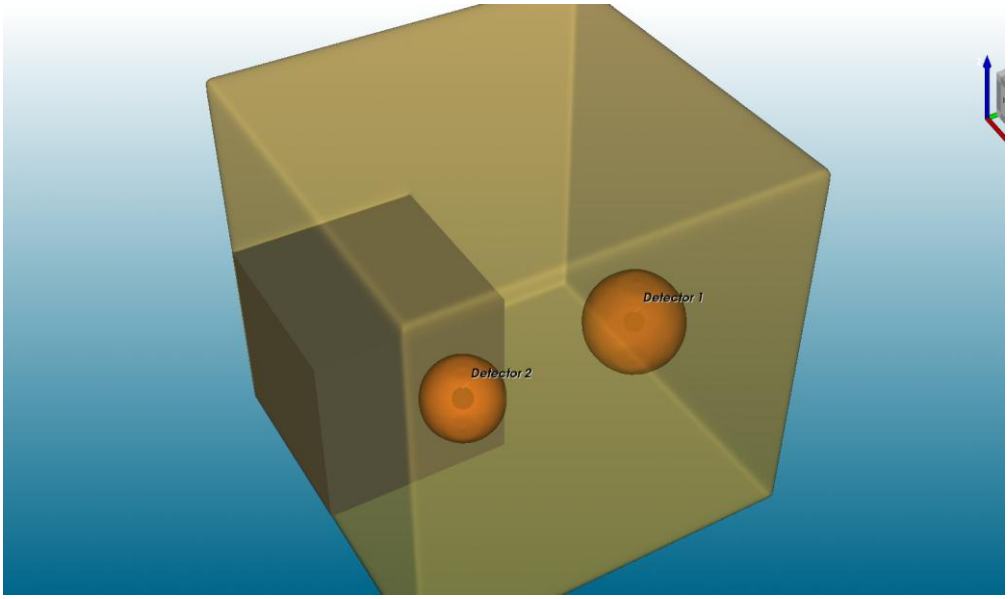
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.6.2 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade. HC detector's FOI is outside the geometry. H2S detector's FOI is half inside the geometry.

Risk Grades

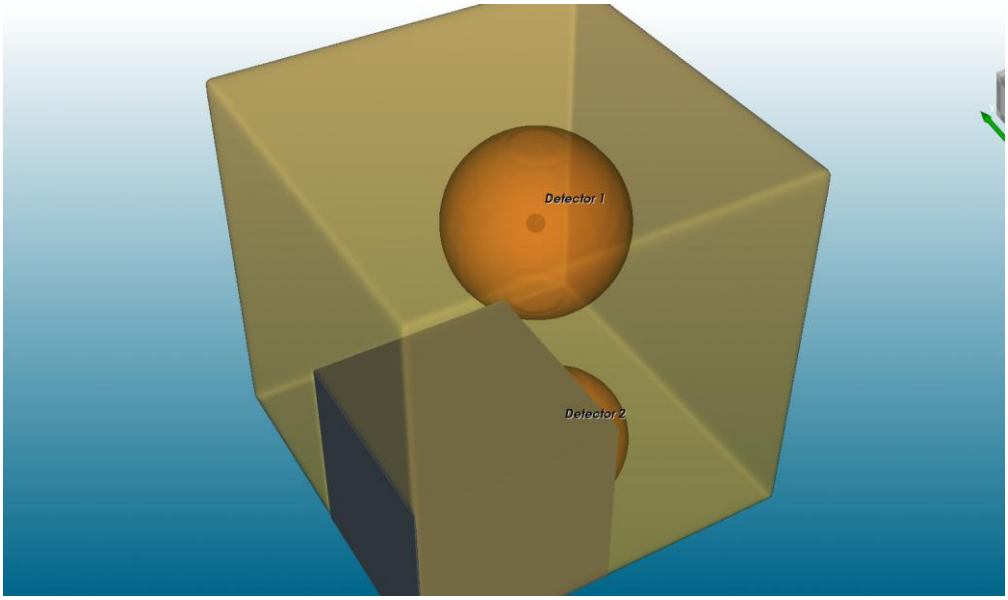
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

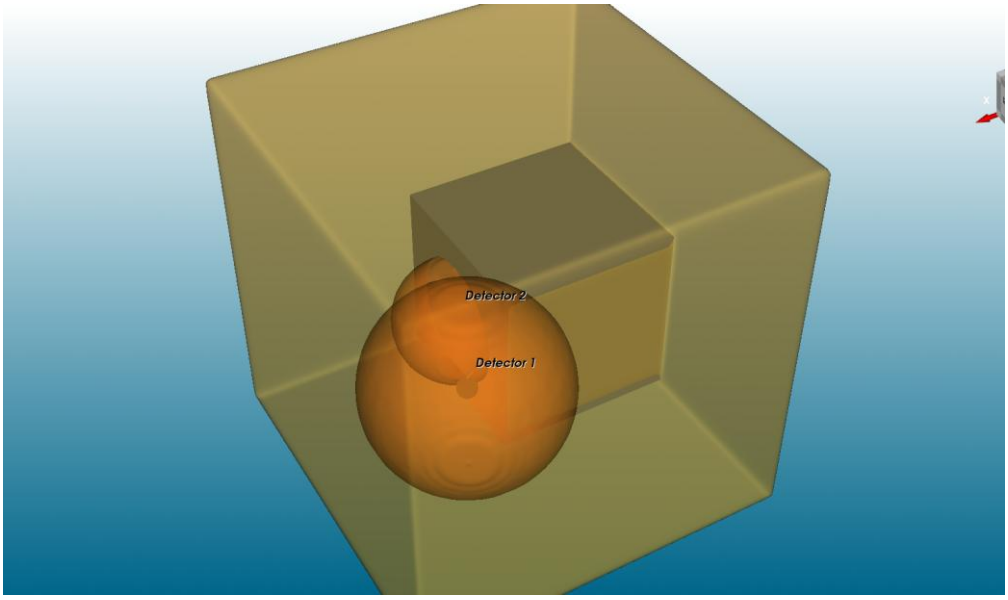
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2S	Grade B - Low 7 m / High 3.5 m

Coverage Results

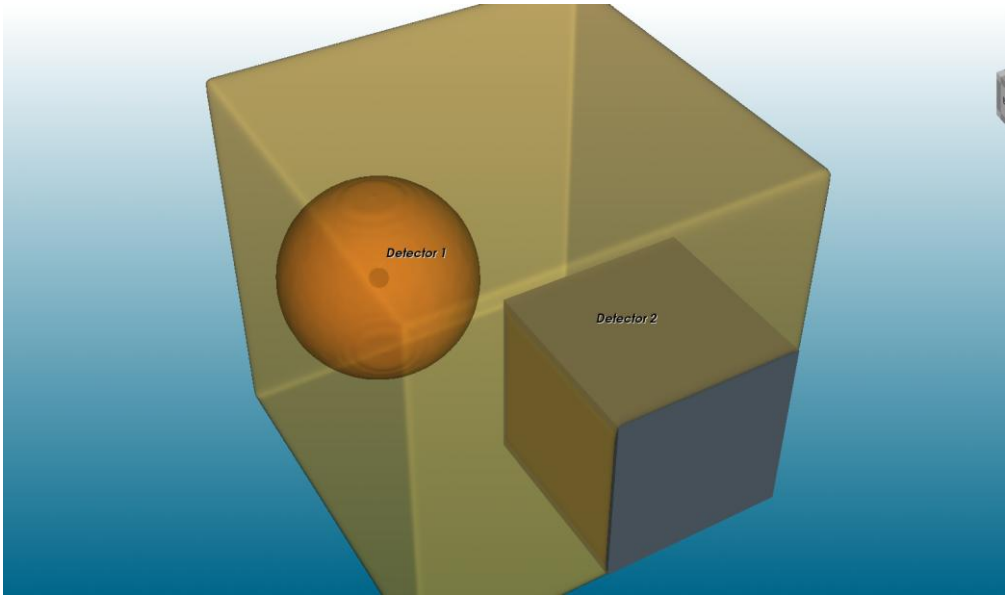
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	8.76	8.74	0.02
Grade B	1ooN	H	1.1	1.1	0.00



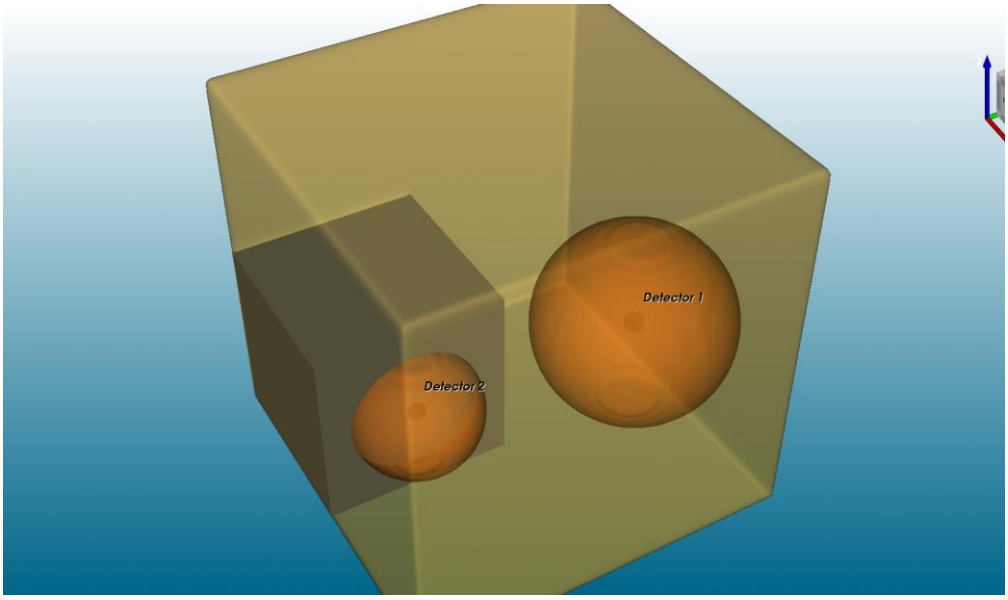
View 1 - L



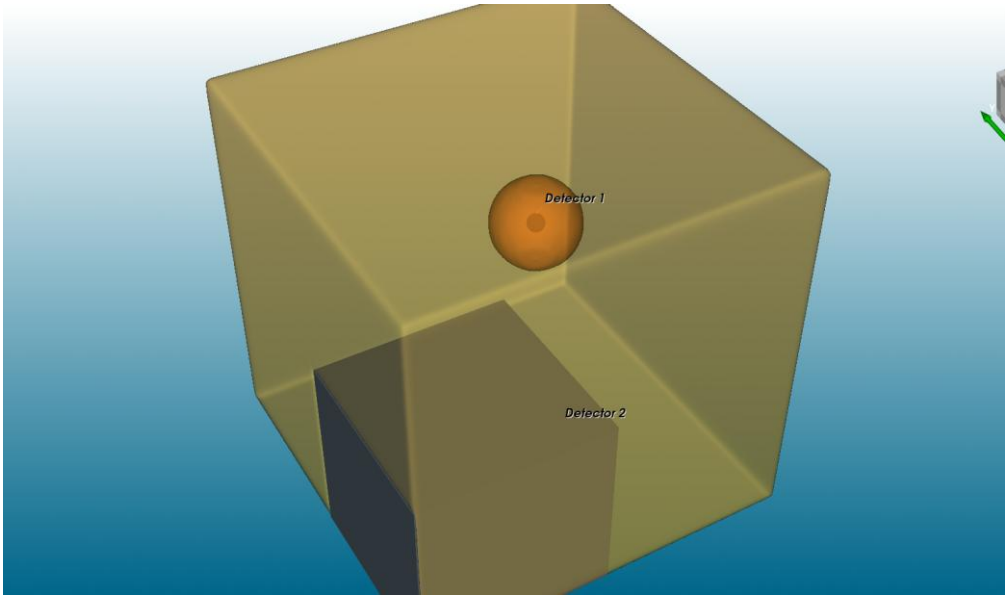
View 2 - L



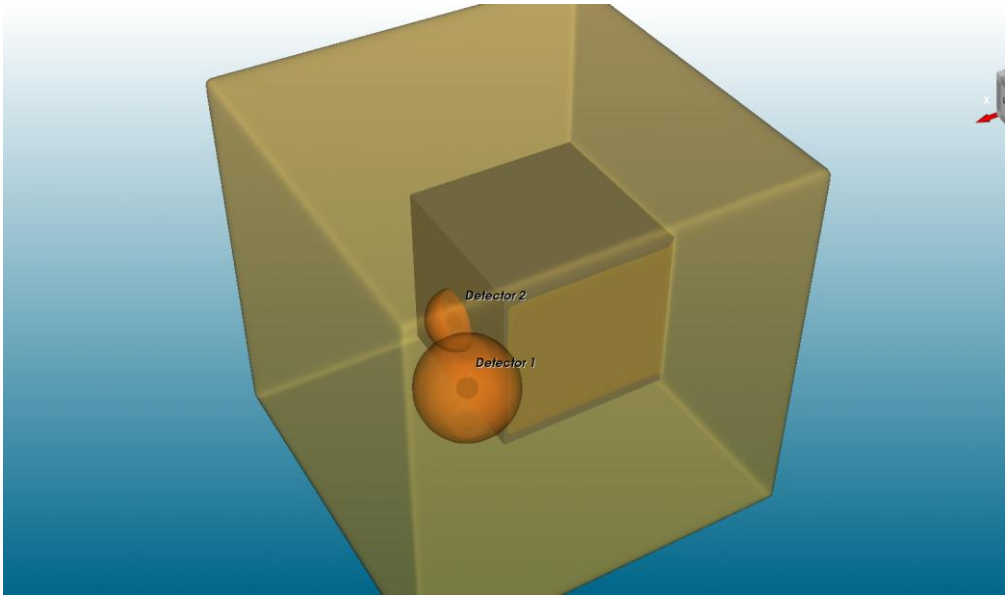
View 3 - L



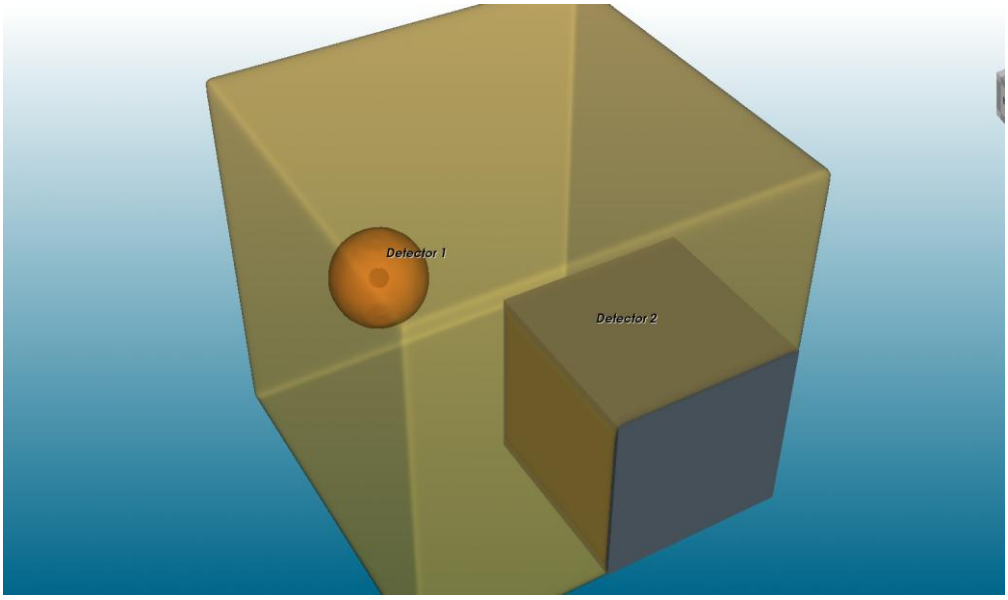
View 4 - L



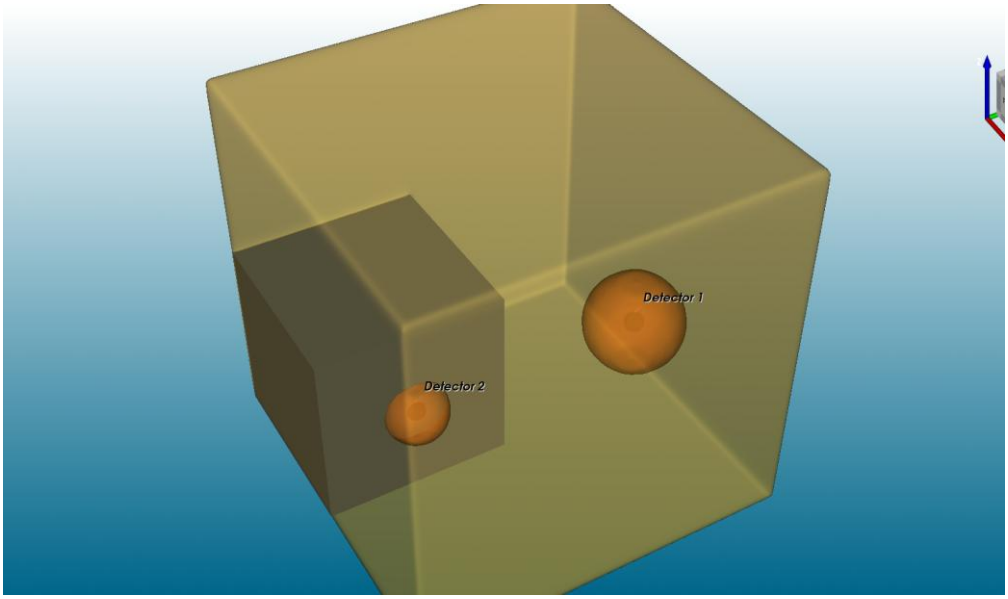
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.6.3 One HC PGD and one H2S PGD with their FOI non-intersecting and completely inside a cubical grade. H2S detector's FOI is outside the geometry. HC detector's FOI is half inside the geometry.

Risk Grades

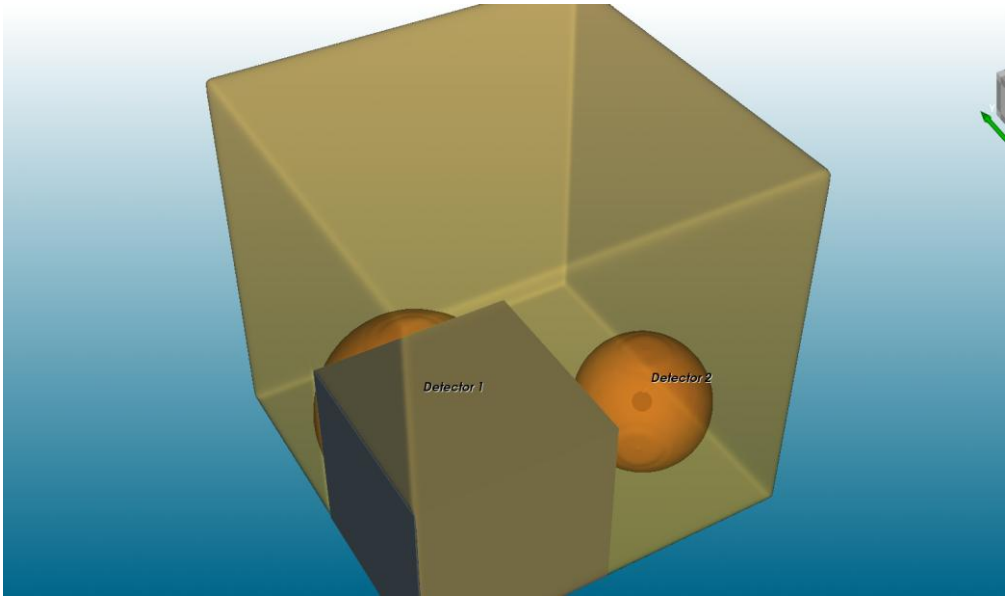
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade B

Gas Detectors

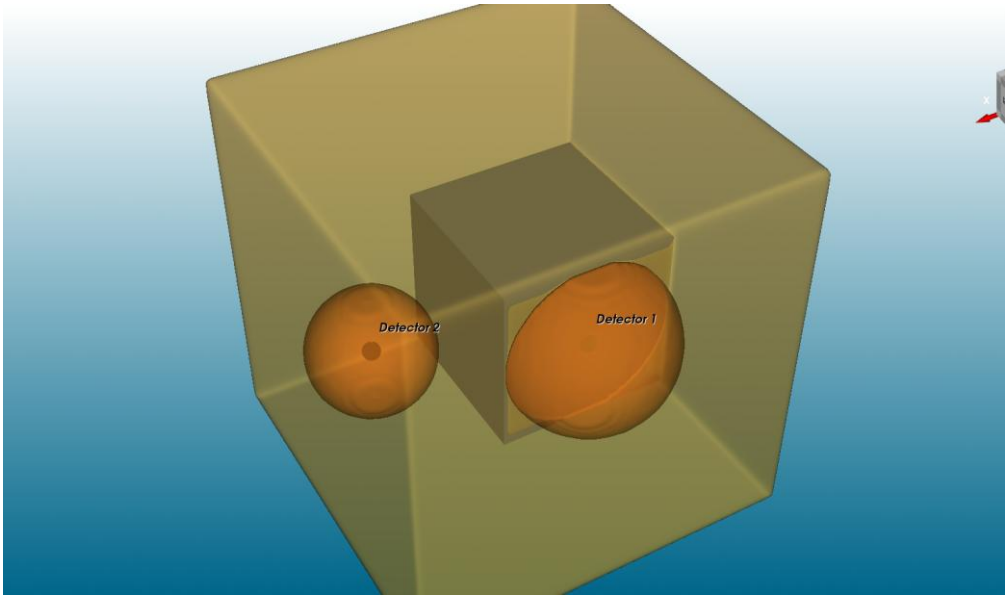
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade B - Low 10 m / High 5 m
Point Gas Detector (PGD)	H2S	Grade B - Low 7 m / High 3.5 m

Coverage Results

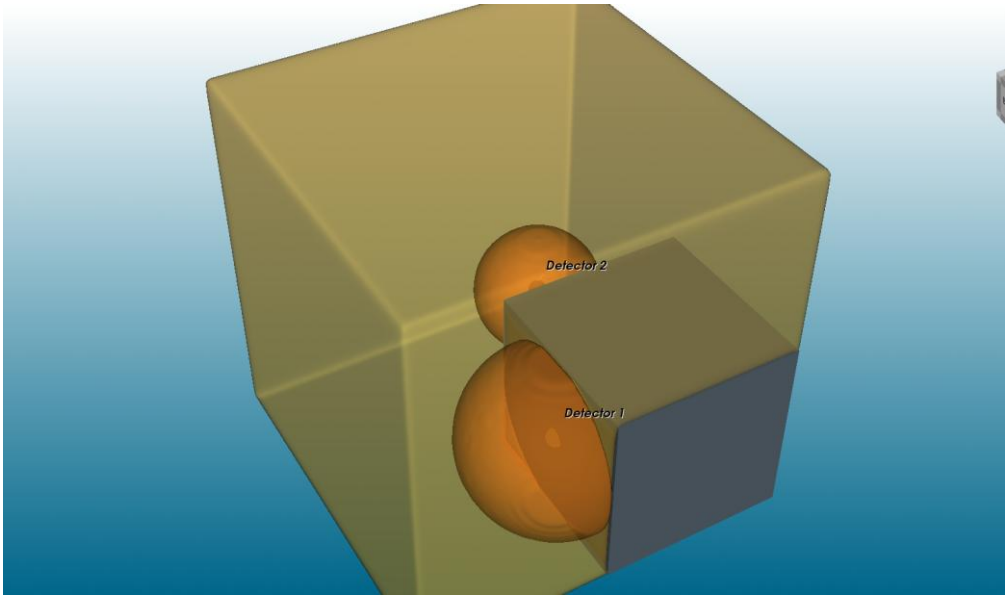
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade B	1ooN	L	6.31	6.24	0.07
Grade B	1ooN	H	0.79	0.78	0.01



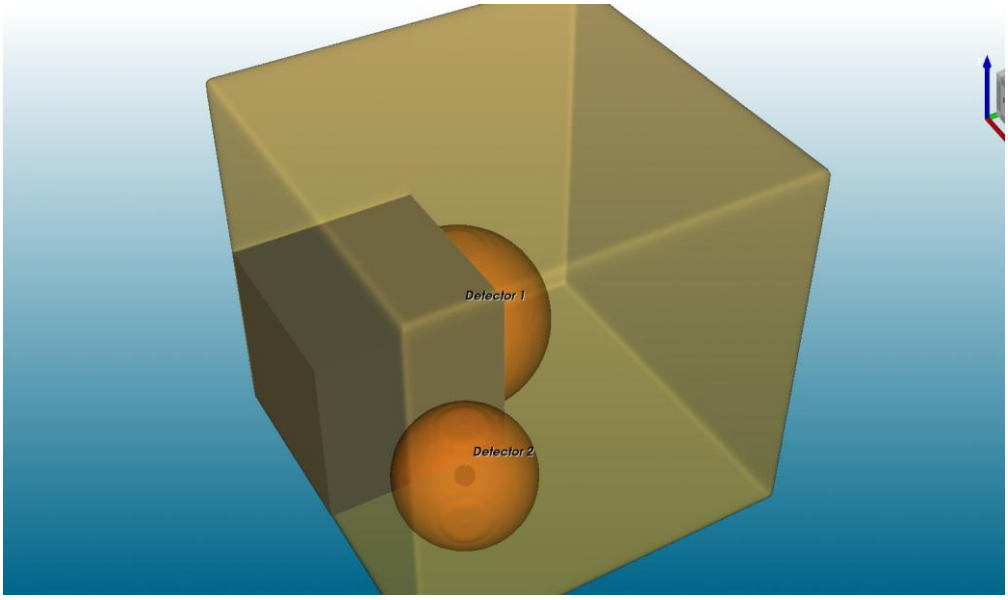
View 1 - L



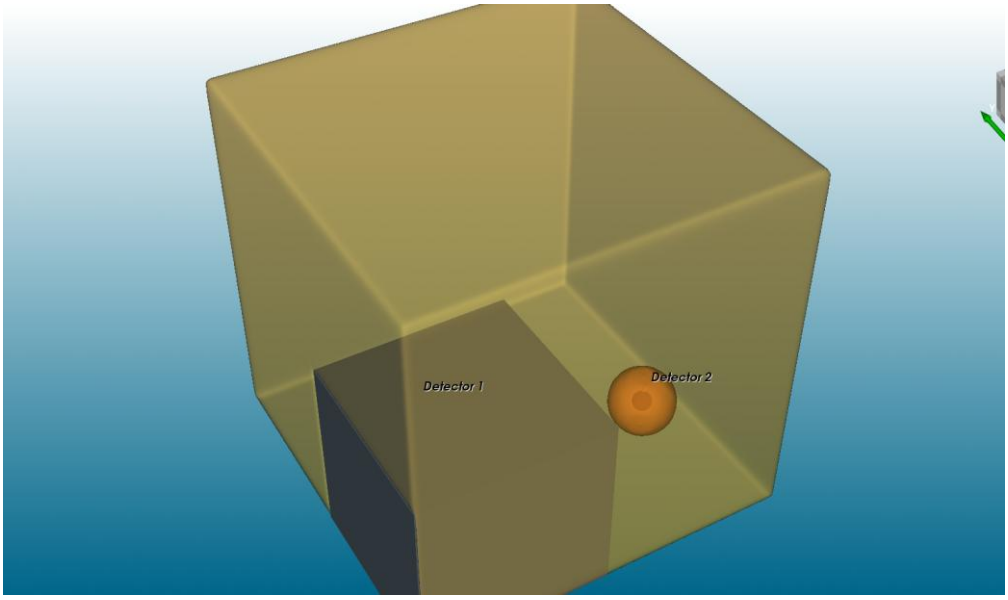
View 2 - L



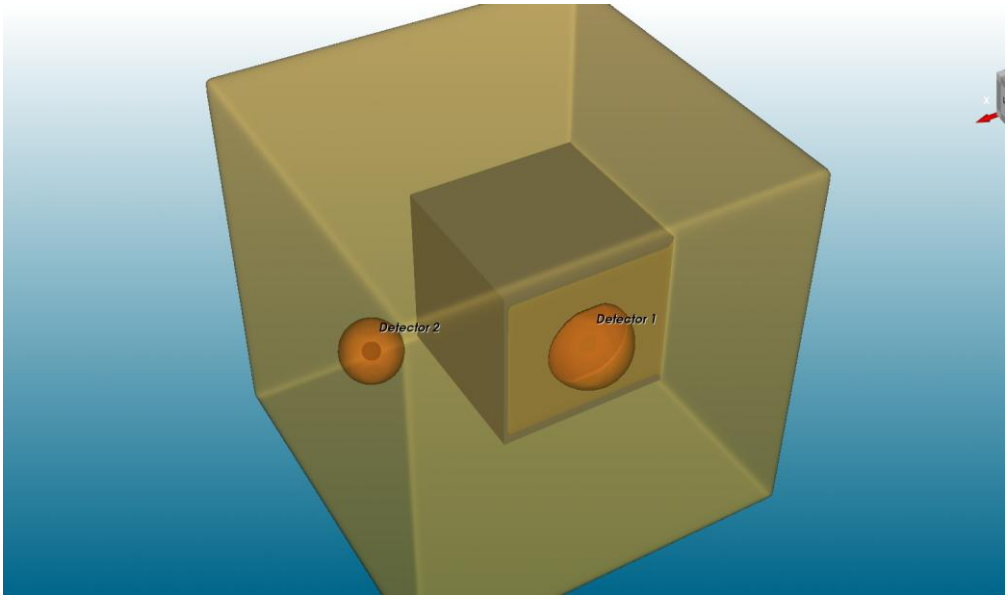
View 3 - L



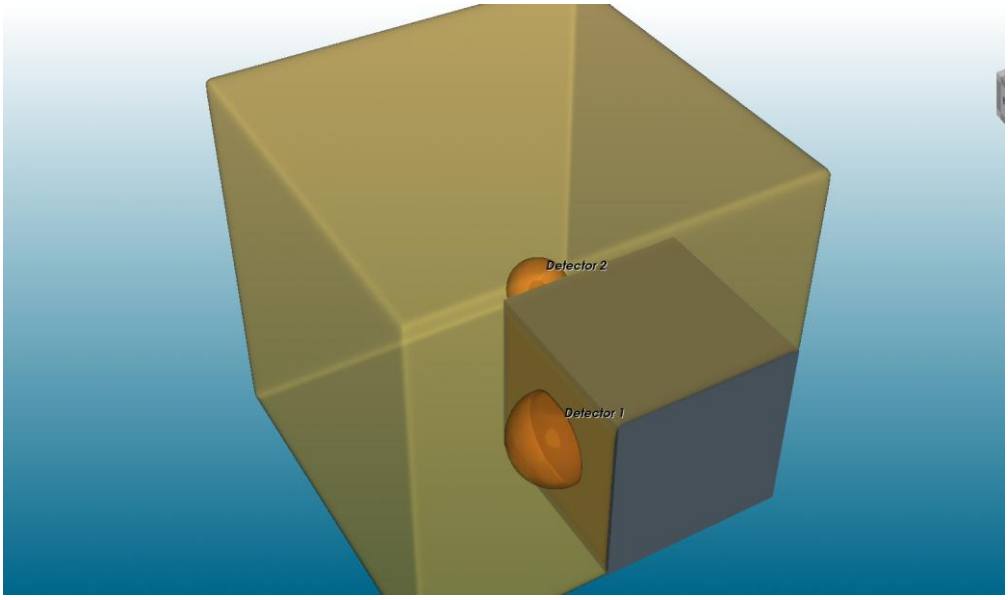
View 4 - L



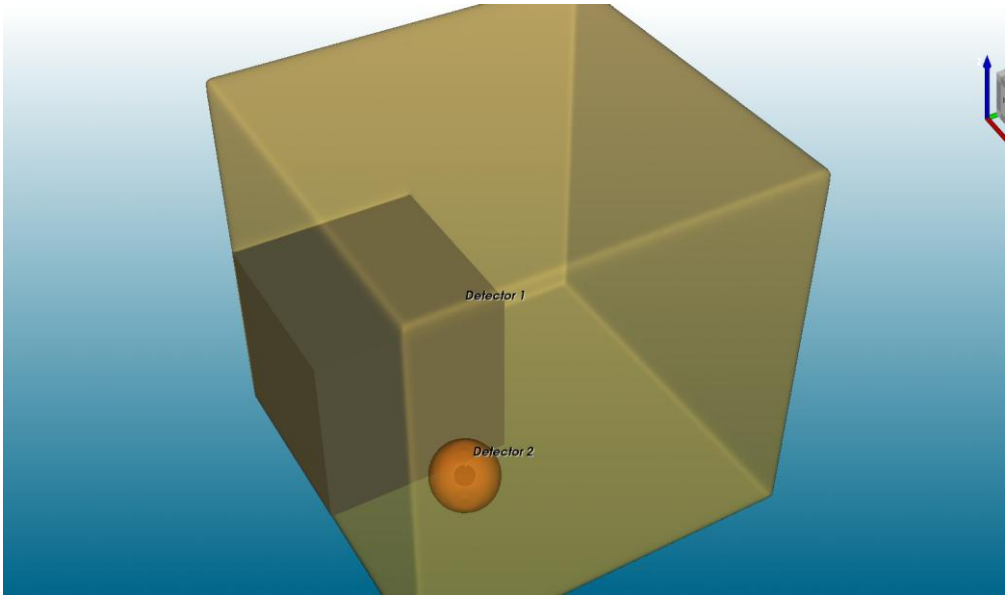
View 1 - H



View 2 - H



View 3 - H



View 4 - H

6.6.4 One HC PGD and one H2S PGD with their FOI overlapping and completely inside a cubical grade but outside the geometry. 2ooN coverage assessed.

Risk Grades

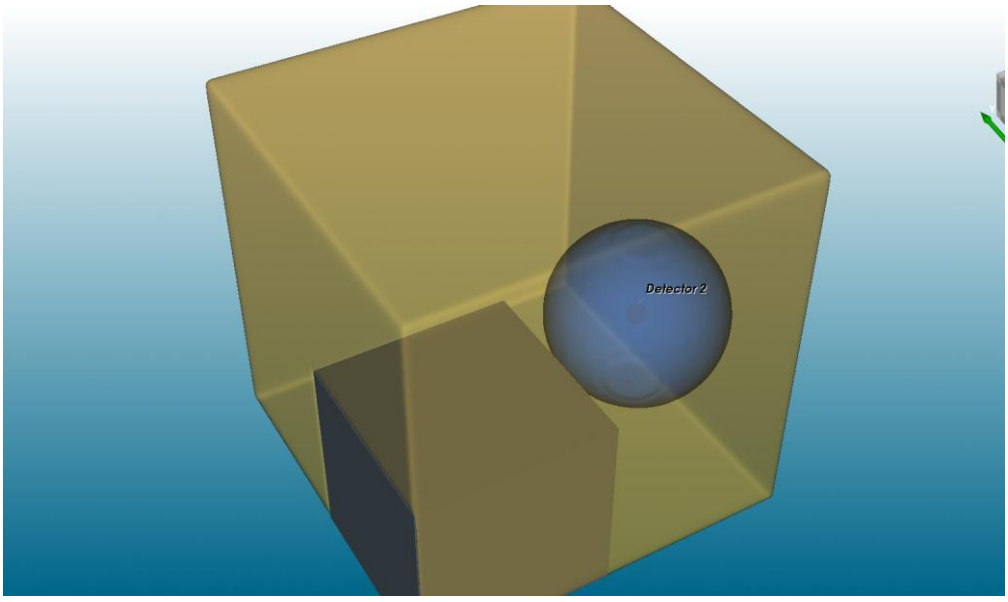
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade A

Gas Detectors

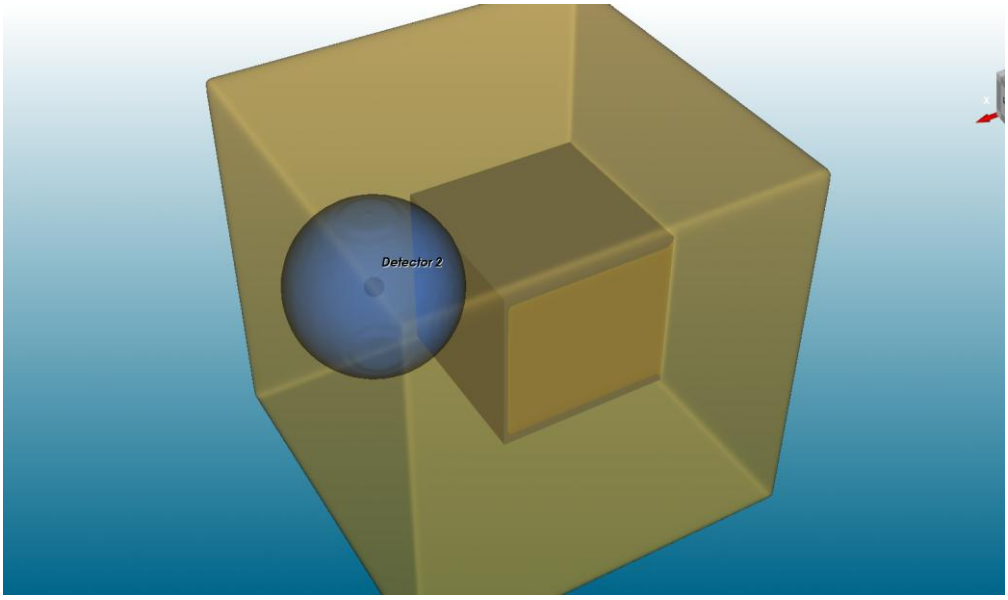
Detector Type	Gas Component	Gas Cloud Diameter (Detection Range)
Point Gas Detector (PGD)	HC	Grade A - Low 10 m / High 8 m
Point Gas Detector (PGD)	H2S	Grade A - Low 9 m / High 7 m

Coverage Results

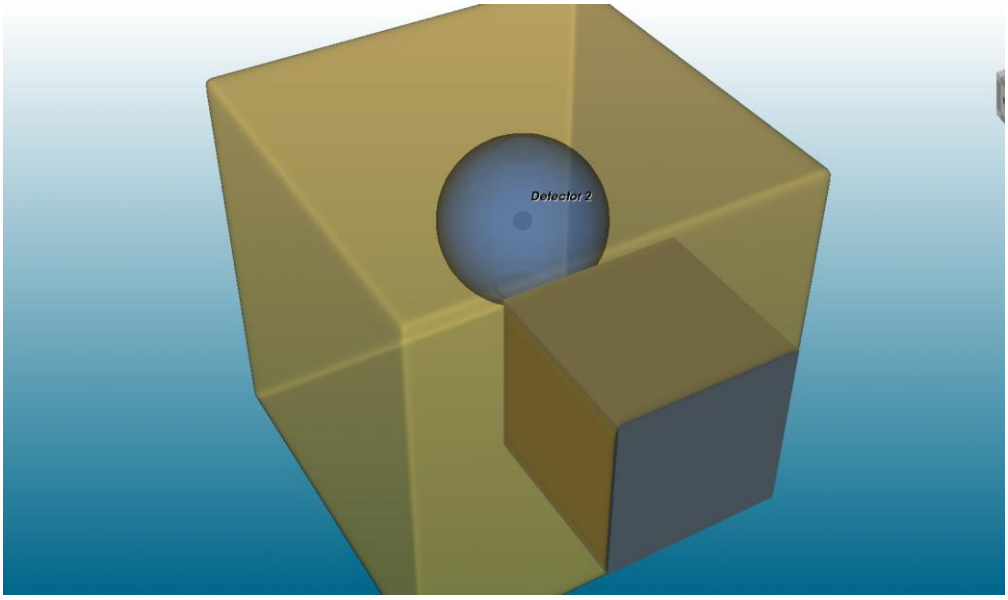
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade A	2ooN	LL	5.45	5.43	0.02
Grade A	2ooN	LH	3.83	3.8	0.03
Grade A	2ooN	HH	2.57	2.55	0.02



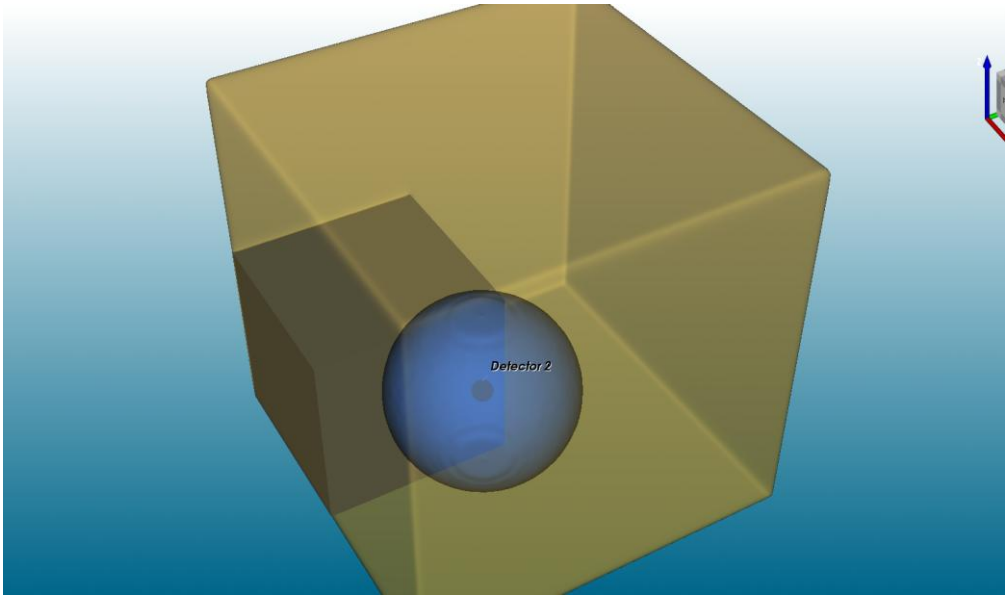
View 1 - LL



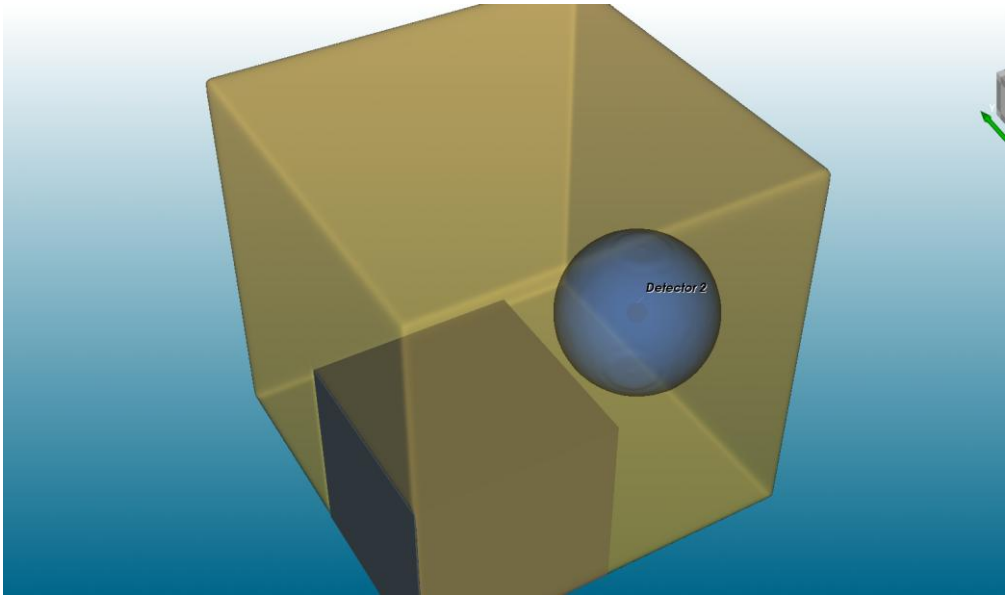
View 2 - LL



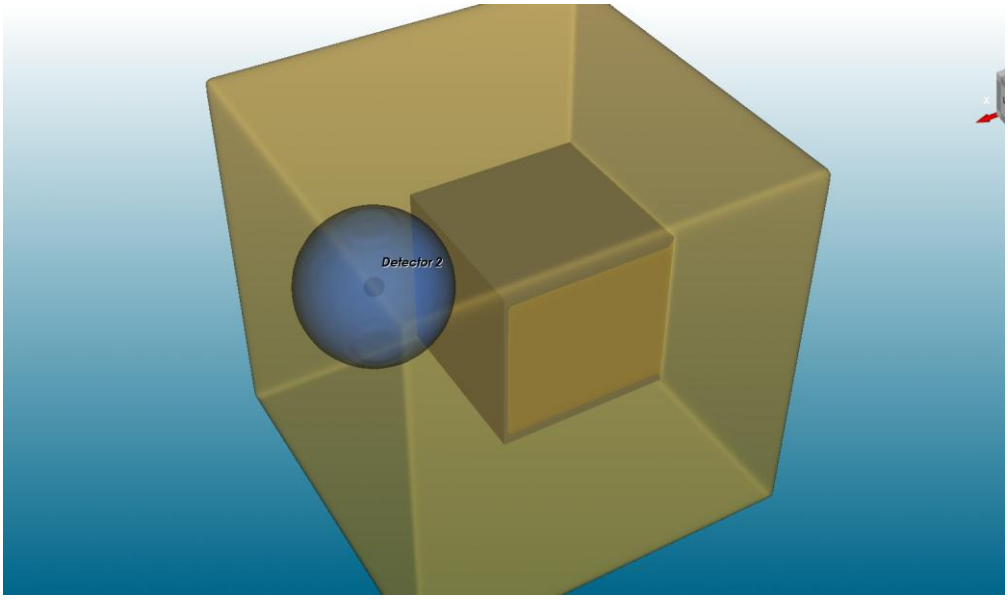
View 3 - LL



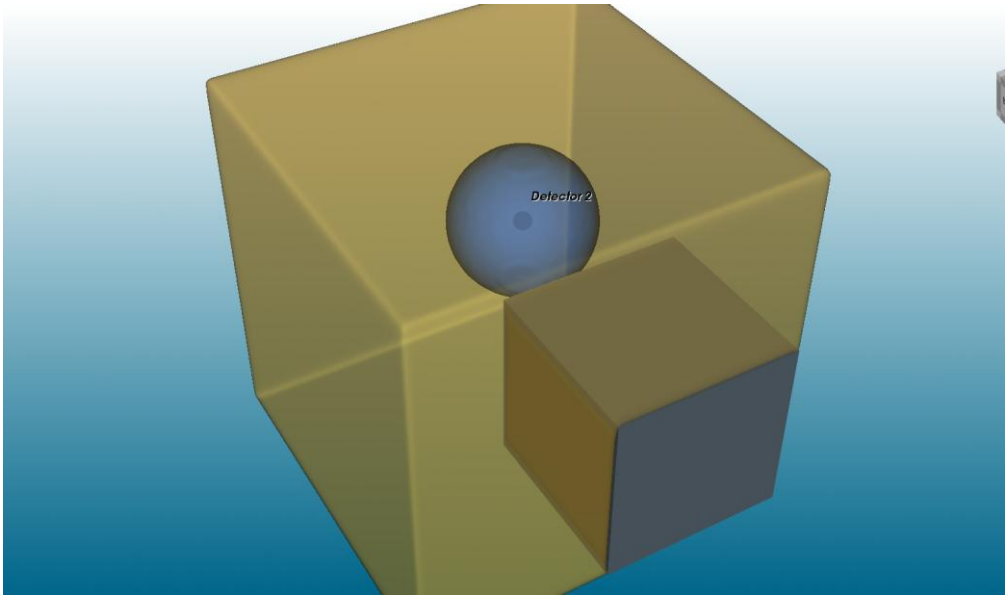
View 4 - LL



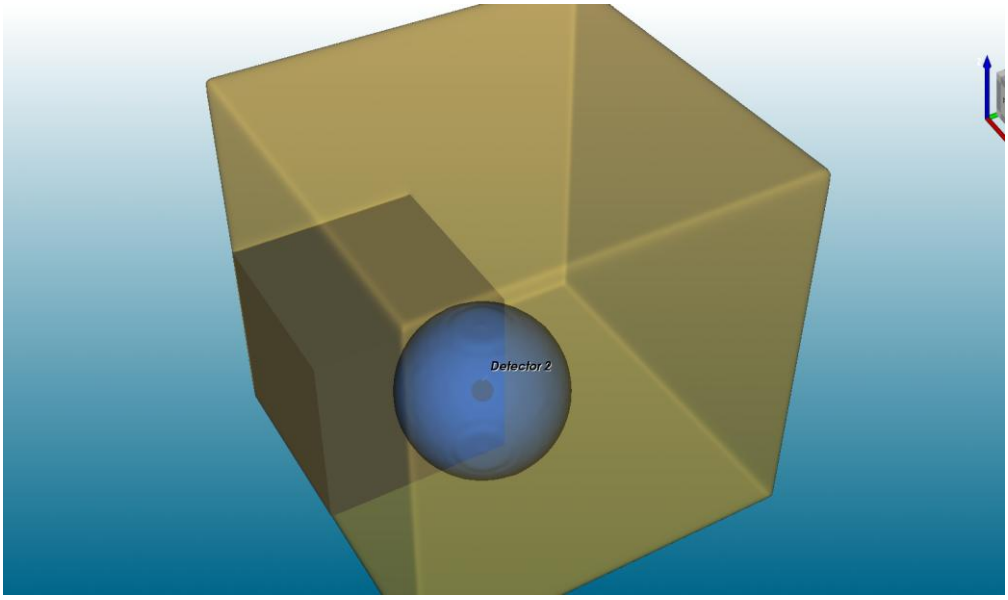
View 1 - LH



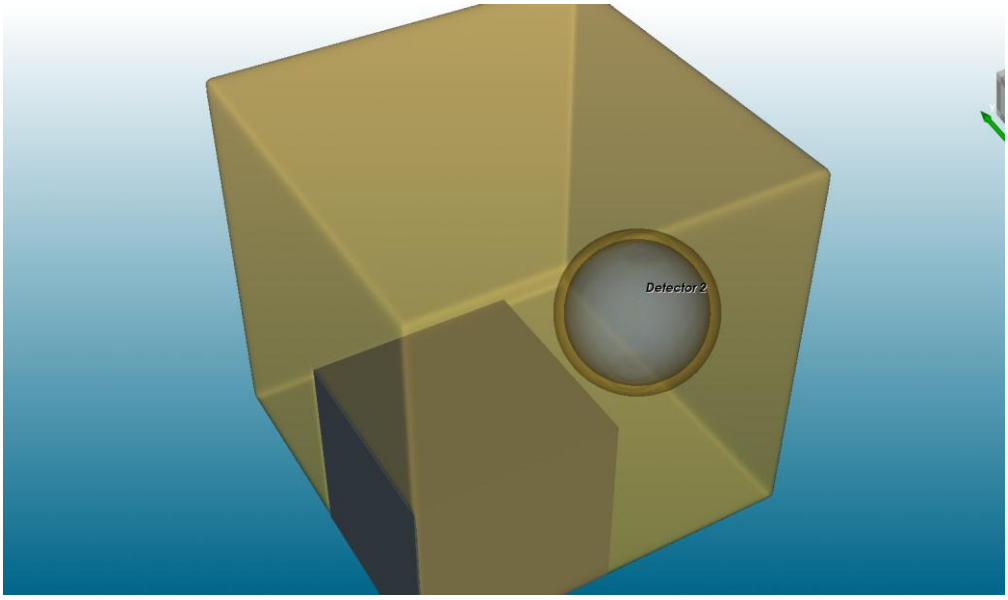
View 2 - LH



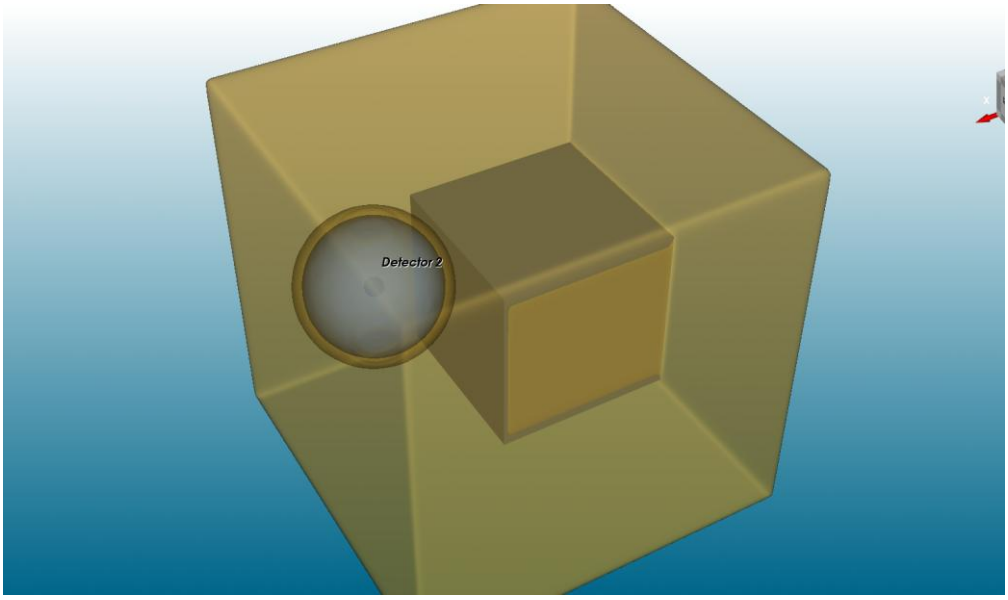
View 3 - LH



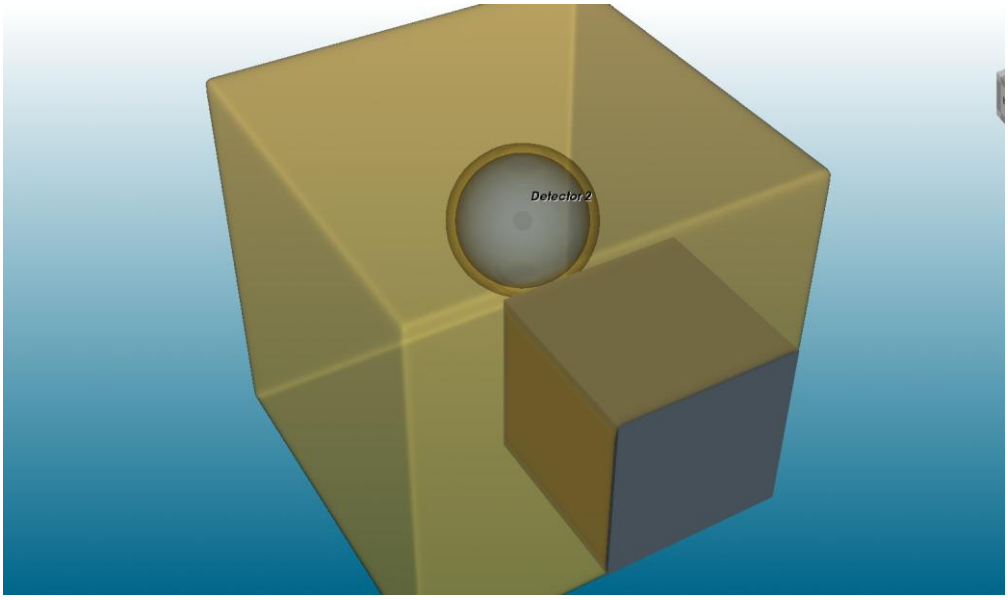
View 4 - LH



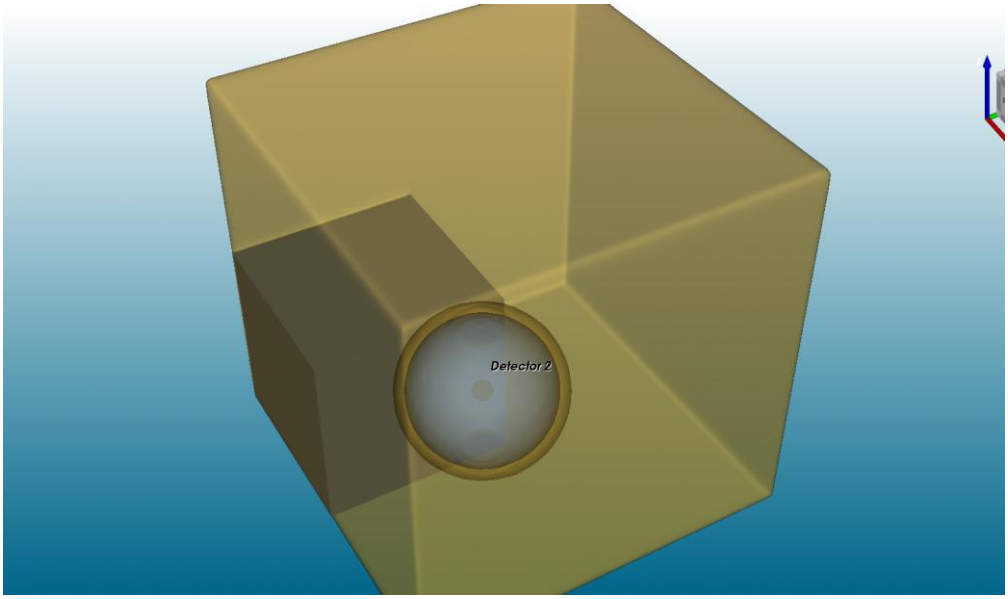
View 1 - HH



View 2 - HH



View 3 - HH



View 4 - HH

6.6.5 One HC OPGD and one H2S OPGD with their FOI non-intersecting and completely inside a cubical grade. HC detector's FOI is outside the geometry. H2S detector's FOI is half inside the geometry.

Risk Grades

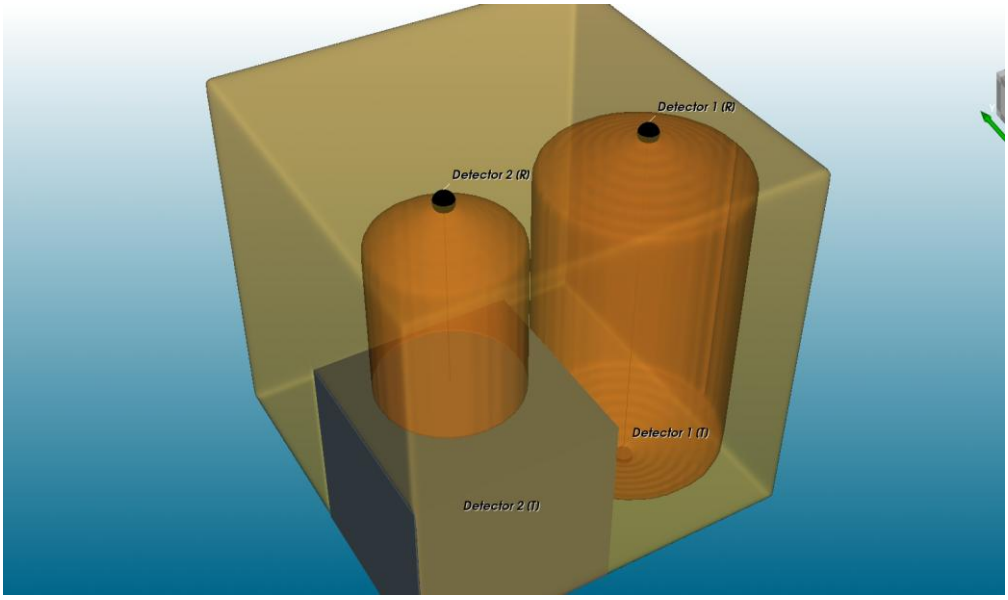
Risk Grade Geometry	Dimensions	Risk Grade Type
Cube	Length 20 m, Width 20 m, Height 20 m	Grade C

Gas Detectors

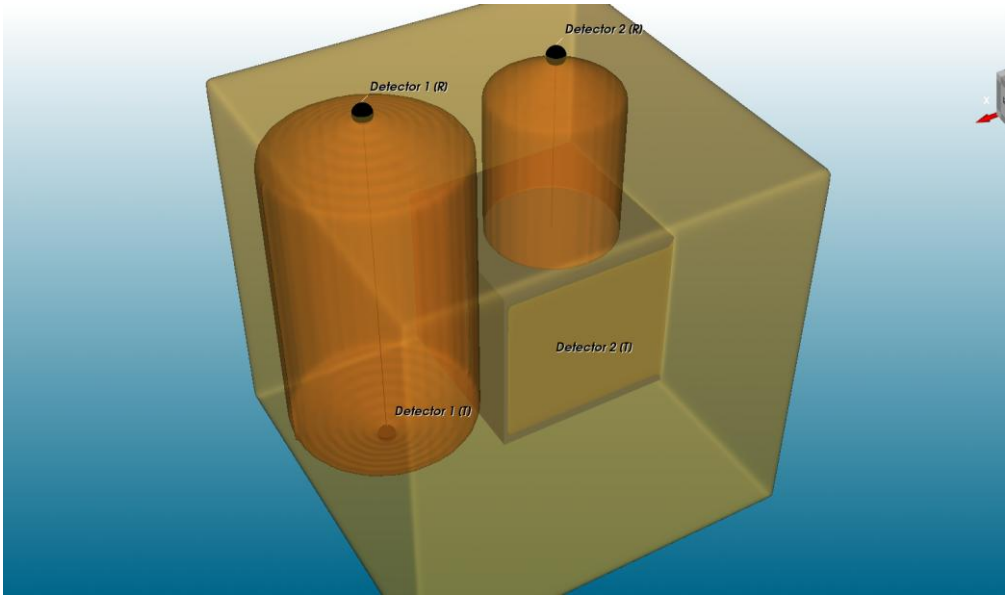
Detector Type	Gas Component	Beam Length	Gas Cloud Diameter (Detection Range)
Open Path Gas Detector (OPGD)	HC	20 m	Grade C - Low 10 m / High 5 m
Open Path Gas Detector (OPGD)	H2S	20 m	Grade C - Low 7 m / High 3.5 m

Coverage Results

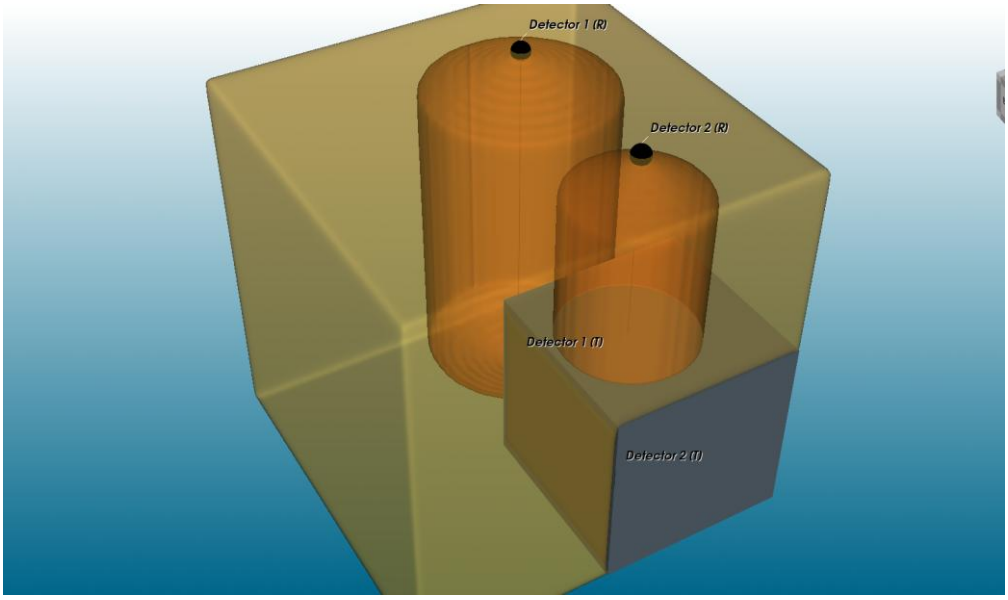
Risk Grade	Voting Logic	Alarm Setting (Low / High)	Analytical Coverage (%)	Software Coverage (%)	Deviation (percentage points)
Grade C	1ooN	L	24.21	24.17	0.04
Grade C	1ooN	H	6.05	6.05	0.00



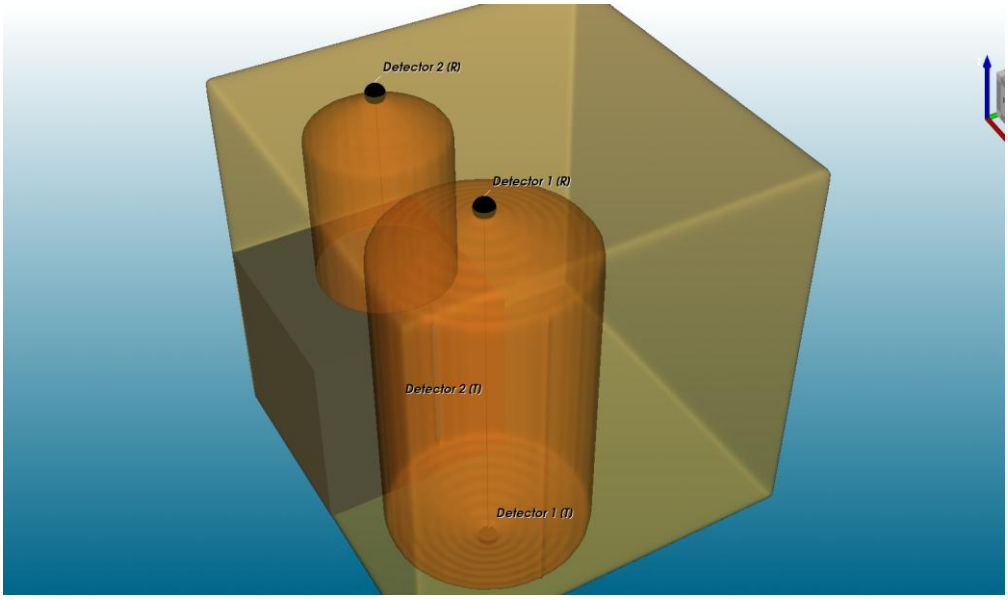
View 1 - L



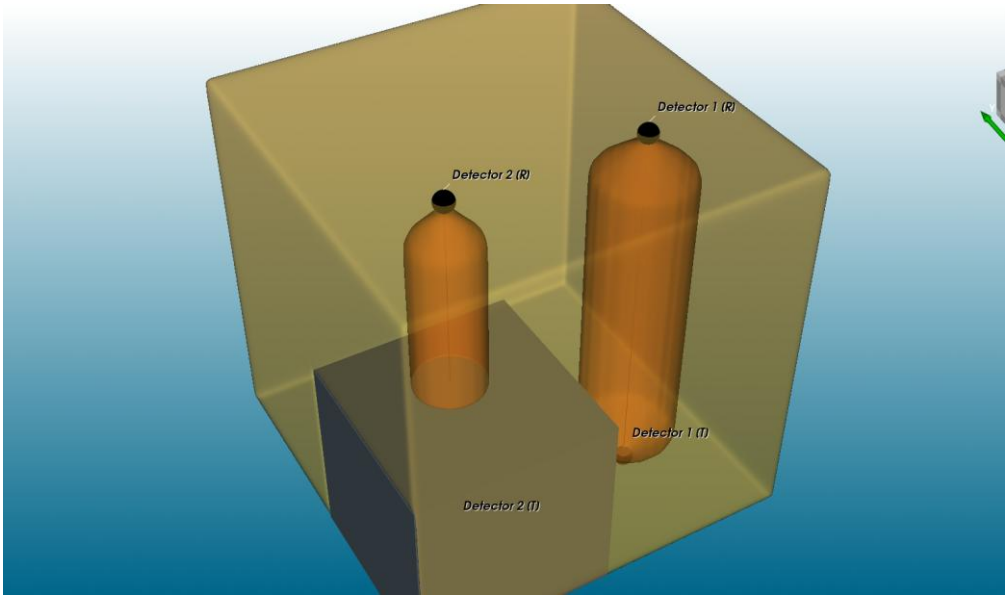
View 2 - L



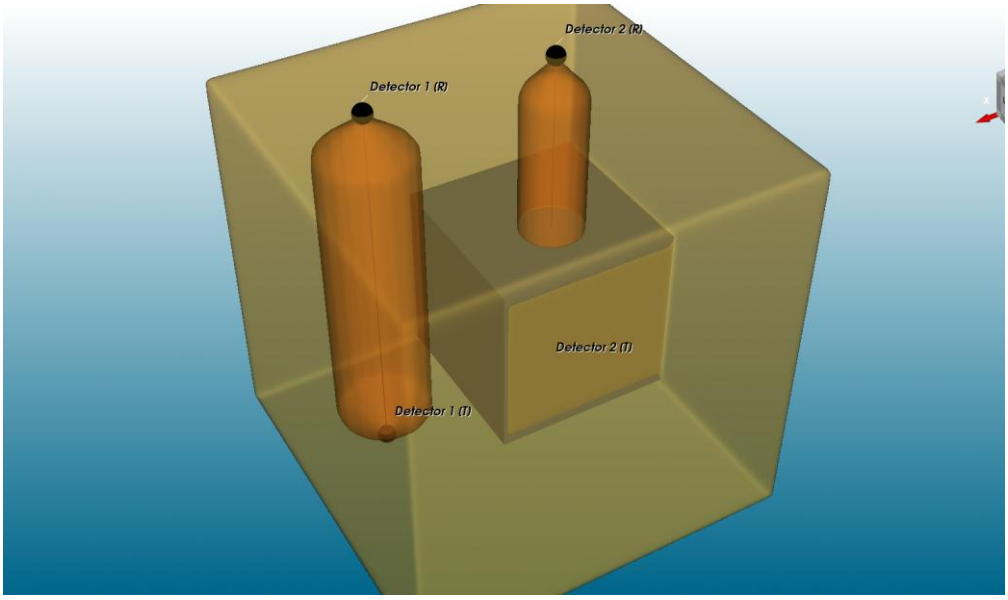
View 3 - L



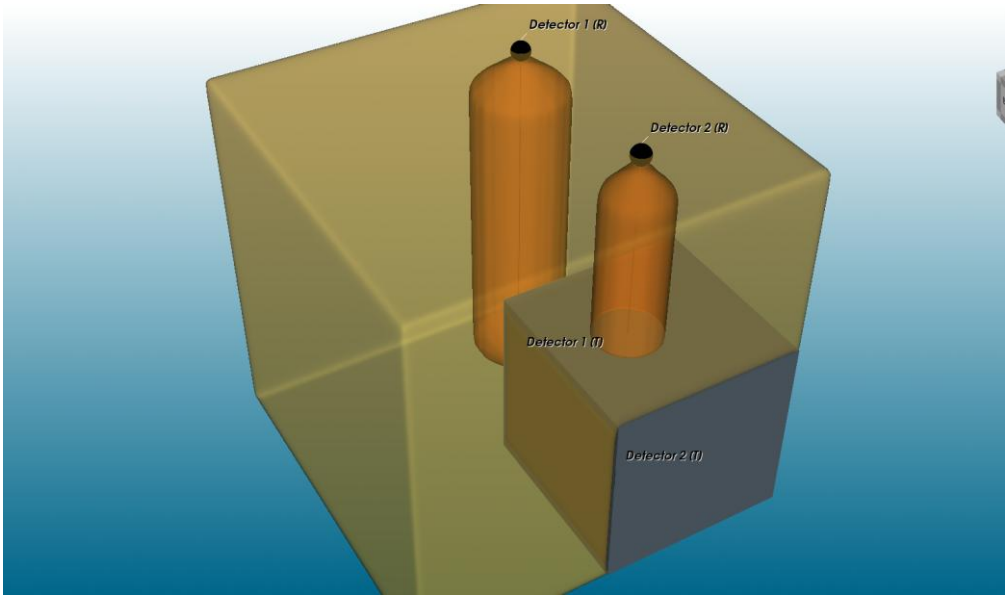
View 4 - L



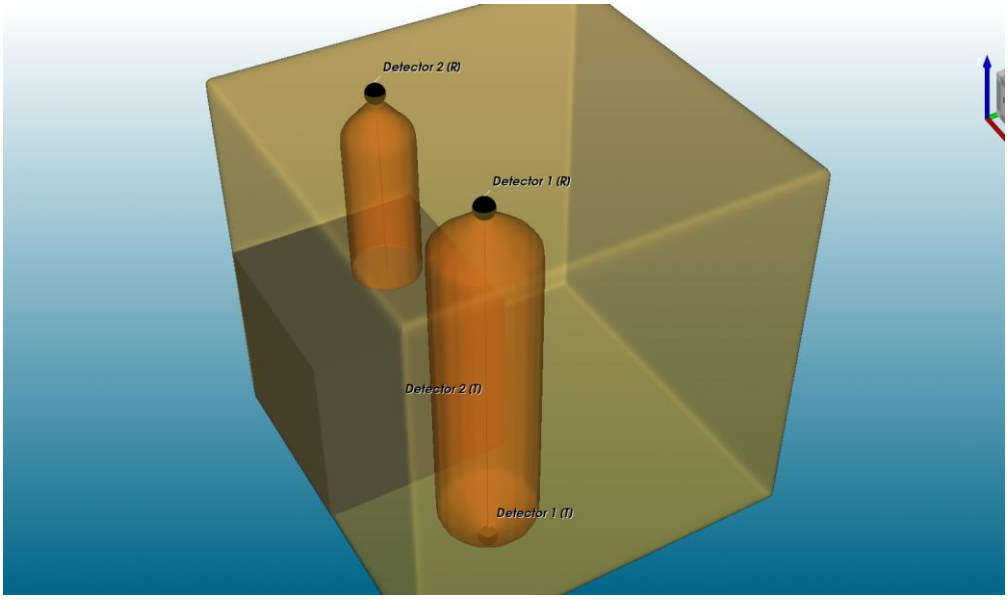
View 1 - H



View 2 - H



View 3 - H



View 4 - H