General Characteristics		
1	**Abstract of Model Capabilities**	COSYMA (Code SYstem from MAria) is a software package for assessing the offsite consequences of accidental releases of radioactive material to the atmosphere. It was developed as part of the European Communities program Methods for Assessing the Radiological Impact of Accidents (MARIA). The COSYMA Project represents a fusion of ideas and models from KfK[2] program system UFOMOD, the National Radiological Protection Board program MARC, and new model developments together with data libraries from other MARIA contractors. COSYMA is a package of programs and data sets. It contains three distinct accident consequence programs, designed for application in different time periods and distance regimes. The Near Early (NE) program calculates early health effects and the influence of emergency actions to mitigate the consequences, and is used in the near-field. The Near Late (NL) program considers only late health effects and the associated mitigating countermeasures, and is also used in the near-field. The Far Late (FL) subsystem is concerned with late health effects at distances far from the site, together with the appropriate countermeasures. COSYMA contains five different models for atmospheric dispersion appropriate for different applications.
2	**Sponsor and/or Developing Organization**	KfK (Germany) NRPB (United Knigdom)
3	**Last Custodian/ Point of Contact**	Dr. Jan van der Steen KEMA Nederland B.V. Postbus 9035 NL-6800 ET arnhem, THE NETHERLANDS PHN: 31-26-356-33-70 FAX: 31-26-442-36-35 E-mail: j.vandersteen@mta9.kema.nl
4	**Life-Cycle**	COSYMA was first released in 1990. Various improvements have been made to this system of codes since its initial development.
5	**Model Description Summary**	COSYMA contains five different models for atmospheric dispersion appropriate for different applications . The NE and NL subsystems use the MUSEMET program, a segmented Gaussian plume model, allowing incorporation of temporal changes in the meteorological conditions. These subsystems are also compatible with the COSGAP and RIMPUFF models, the latter a Gaussian puff trajectory model. The FL subsystem uses the MESOS model intended to address transport and dispersion over large distances. The NL subsystem can also be used with ISOLA, a model for very long duration releases which are sufficiently small that no countermeasures will be expected. External irradiation pathways are considered with a variety of countermeasures to be considered. Doses, and early and latent health effects are calculated based on United Kingdom, United States, and Federal Republic of Germany models.
6	**Application Limitation**	Limited application in regions of complex terrain.
7	**Strengths/ Limitations**	**Strengths:** Various atmospheric transport and dispersion models (straight-line trajectory). Statistics through weather variability. Single/multiple stations meteorological input. Flexible output. Continuous development and active user's group. Full tritium dispersion capability. **Limitations:** Lack of extensive experience with the code in the United States.
9	**Input Data/Parameter Requirements**	User-specified deposition velocities for five different isotope classes Noble gases, vapor, aerosols Elemental, organic or aerosol-type phase iodine Hourly wind speed, wind direction, rainfall rate, atmospheric stability class.
10	**Output Summary**	Expectation Percentiles Probability of zero effects CCDF's Intermediate results on air/land contamination Health effects Risks at specific grid points and associated probability distributions Doses/effects with and without countermeasures by pathways and radionuclides.
11	**Applications**	COSYMA has a wide range of applications due to its many modules and models that address all aspects of consequence assessment.

Specific Characteristics		
Part A: Source Term Submodel Type		
A1	**Source Term Algorithm?**	✔ YES __ NO
A3	**For Radiological Consequence Assessment Models**	**Gaseous releases: ✔ noble gases ✔ iodines __ other non-reactive gases (9 groups; radioiodines split into 3 groups)** **Aerosol releases: Radioiodines and noble gases** **Chemistry __ Isotopic exchange __ Physical properties capability**
Part B: Dispersion Submodel Type		
B1	**Gaussian**	**__Straight-line plume ✔ Segmented plume __ Statistical plume __ Statistical puff**
Part C: Transport Submodel Type		
C2	**Deterministic**	Yes
C4	**Frame of Reference**	**✔ Eulerian __ Lagrangian __ Hybrid __ Eulerian-Lagrangian**
Part D: Fire Submodel Type (Not Applicable)		
Part E: Energetic Events Submodel Type (Not Applicable)		
Part F: Health Consequence Submodel Type		
F2	**For Radiological Consequence Assessment Models**	**Cloudshine: __ finite cloud ✔ semi-infinite cloud __ other** **Groundshine: ✔ short-term ✔ long-term** **Inhalation: ✔ short-term ✔ long-term** **✔ Total effective dose equivalent** **✔ Uptake of respirable fraction of particle spectra** **Resuspension: ✔ short-term ✔ long-term __ Anspaugh** **Food/Water Ingestion: ✔ dynamic _ static** **Skin dose: ✔ absorption ✔ other** **Dose assessment: ✔ ICRP-60 criteria ✔ organs ✔ pathways** **Health effects: ✔ early ✔ latent**
Part G: Effects and Countermeasures Submodel Type		
G2	**Radiological Consequence Assessment Models**	**Land contamination:** **Economic costs: ✔ decontamination ✔ interdiction** **✔ foodstuff losses ✔ denial of facility access ✔ victim treatment** **Evacuation: Yes** **Sheltering: Yes** **Interdiction: Yes** **Decontamination: Yes**

Part H: Physical Features of Model		
H2	**Release Elevation**	**_✔_ ground _✔_ roof**
H3	**Aerodynamic Effects from Buildings and Obstacles**	**_✔_ building wake __ cavity __ K-factors __ flow separation** **NR models only.**
H6	**Mixing Layer**	**_✔_ trapping _✔_ lofting _✔_ reflection __ penetration** **__ inversion breakup fumigation __ temporal variability**
H7	**Cloud Buoyancy**	**_✔_ neutral [passive] __ dense [negative] _✔_ plume rise [positive]**
H9	**Radio(chemical) Transformation and In-Cloud Conversion Processes**	Tritium only using UFOTRI module (conversion of HT into HTO; organic binding of HTO)
H10	**Deposition**	**__ gravitational setting _✔_ dry deposition _✔_ precipitation scavenging** **__ resistance theory deposition __ simple deposition velocity __ liquid deposition** **__ plateout and re-evaporation**
H11	**Resuspension**	Included.
H12	**Radionuclide Ingrowth and Decay**	Radionuclide decay/daughter ingrowth included.
Part I: Model Input Requirements		
I1	**Radio(chemical) and Weapon Release Parameters**	**Release rate: _✔_ Continuous _✔_ Time dependent __ Instantaneous** **Release container characteristics: __ vapor temperature __ tank diameter** **__ tank height __ tank temperature __ tank pressure __ nozzle diameter** **__ pipe length** **Jet release: __ initial size __ shape** **__ concentration profile at end of jet affected zone** **Release dimensions: __ point __ line __ area** **Release elevation: __ ground __ roof __ stack**
I2	**Meteorological Parameters**	**Wind speed and wind direction: _✔_ single point __ single tower/multiple point** **__ multiple towers** **Temperature: _✔_ single point __ single tower/multiple point** **__ multiple towers** **Dew point temperature: __ single point __ single tower/multiple point** **__ multiple towers** **Precipitation: _✔_ single point __ single tower/multiple point** **__ multiple towers** **Turbulence typing parameters: __ temperature difference** **__ sigma theta** **__ sigma phi __ Monin-Obukhov length __ roughness length** **__ cloud cover __ incoming solar radiation _✔_ user-specified** **Four dimensional meteorological fields from prognostic model:**

Part J: Model Output Capabilities		
J1	**Hazard Zone**	Intermediate results on air/land contamination. Health effects.
J4	**Tabular at Fixed Downwind Locations**	Doses/effects with and without countermeasures by pathways and radionuclides.
J7	**Graphic Contours of Probability of Exceeding Concentration**	Probability of zero effects CCDF's
J8	**F-N Probability Distribution Curves**	Risks at specific grid points and associated probability distributions.
Part K: Model Usage Considerations (No Information Provided.)		