General Characteristics		
1	**Abstract of Model Capabilities**	DOSEEP is a Gaussian Plume model used to estimate external radiation exposures from gaseous emissions following an underground nuclear explosion. The emissions typically occur some time after a detonation in the order of hours to days, thus there is essentially no thermal buoyancy to the emissions. The model additionally has been used to make estimates of exposures from forced ventilation of contaminated tunnels.
2	**Sponsor and/or Developing Organization**	NOAA, ARL/SORD P.O Box 94227 Las Vegas, NV 89193-4227 (702) 295-1231 (702) 295-3068 **Fax** soule@doe.nv.gov **sponsoring organization** soule@doe.nv.gov **developing organization**
3	**Last Custodian/ Point of Contact**	NOAA, ARL/SORD P.O. Box 94227 Las Vegas, NV 89193-4227 (702) 295-1231 (702) 295-1231 **Fax** soule@doe.nv.gov **primary individual** soule@doe.nv.gov **secondary individual**
4	**Life-Cycle**	This model was developed in the mid 70s for underground nuclear tests. The main impetus behind the model was from the experiences of previous tests where “seepages” occured. It was applied during the actual tests, along with the analog venting model PIKE, for predicting potential hazards from mixed radionuclides after a detonation. The model has not been changed since the 1970s.
5	**Model Description Summary**	DOSEEP is a gaussian plume model that predicts downwind centerline exposures from releases after underground nuclear detonations. The model was developed after a series of “seepages” occured following tests. The main emphasis was toward radioactive gases that might be released after an event. These releases included unplanned and planned releases, such as occurred after tunnel test. Due to the time constraints, which were generally in the range of hours after a detonation, gaseous radionuclides were considered the main hazards, thus the gaussian plume approach was deemed the correct one at the time.
6	**Application Limitation**	The model only predicts centerline exposures, has no terrain effects capabilities, and probably over predicts the hazardous potential from releases when the distances are more than 10 to 10 miles. The model is only appropriate for gaseous releases and has no deposition capabilities.
7	**Strengths/ Limitations**	**Strengths:** The model is easy to use. It requires only a source term, wind speed, and stability. It can easily be run on a PC. **Limitations:** Simplistic gaussian plume assumptions, specifically designed for releases from underground nuclear tests.
8	**Model References**	In-house documentation only.
9	**Input Data/Parameter Requirements**	Release rate is curies, stability, wind speed
10	**Output Summary**	Air bourne concentrations, exposure rates, and integrated doses
11	**Applications**	Used for releases after underground nuclear tests, both unplanned and planned. Some verification has been done on the predicted down-wind values, which usually has shown that the model tends to over predict the hazard at longer distances.
12	**User-Friendliness**	The model is run by a command line interface with input from the users terminal and output to either the terminal or to a printer.
13	**Hardware-Software Interface Constraints/ Requirements**	**Computer operating system:** Data General MV series AOS/VS, and MS DOS **Computer platform:** Data General MV 9600, PCs **Disk space requirements:** Less than 1 megabyte **Run execution time** (for a typical problem)**:** 1 minute **Programming language:** FORTAN **Other computer peripheral information:**
14	**Operational Parameters**	**Identify whether the code has any error diagnostic messages to assist the user in troubleshooting operational problems:** None **Set up time for: Typical times are:** ***first-time user:*** .5-10 minutes ***experienced user:*** 2 min

15	**Surety Considerations**	**All quality assurance documentation:** None **Benchmark runs:** None available **Validation calculations:**. Field results only **Verification with field experiments that has been performed with respect to this code:** Verification from planned releases
16	**Runtime Characteristics**	About 1 minute or less.
		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** **Aerosol releases:** **Particulate releases:** **___ 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	
C1	**Prognostic**	None.
C2	**Deterministic**	Gaussian Plume Model relying on current conditions
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-finite 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**
F3	**For Weapons Consequence Assessment Models**	**Health effects: ✔ fatalities ✔ cancers ✔ latent cancers__ symptom onset** **Health criteria** **__ IDLH __ STEL __ TLV __ TWA** **__ ERPG __ TEEL __ AEGL** **Risk quantification:** **Concentration: __ single value ✔ time-history ✔ integrated dose** **Probits:**
	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:** Downwind people would be evacuated if calculations indicated a health hazards that could not be mitigated by sheltering. **Sheltering:** Sheltering would be done for cases where the hazard was indicated to be small or of short duration. **Interdiction:** **Decontamination:**

G3	**For Weapons Consequence Assessment Models**	**Land contamination:** **Economic costs:** Costs could accrue if evacuation were necessary. **Evacuation:** Evacuation would be used only if the potential hazard could not be mitigated by sheltering. **Sheltering: Would be the preferred method of hazard mitigation for people in the downwind sector.** **Interdiction:**
Part H: Physical Features of Model		
H1	**Stability Classification Turbulence Typing**	**Pasquill-Gifford-Turner:** ✔ **STAR:** ✔ **Irwin:** **Sigma theta:** **Richardson number:** **Monin-Obukhov length:** **TKE-driven:** **Split sigma:**
H2	**Release Elevation**	**_✔_ ground __ roof**
H4	**Horizontal Plume Meander**	Shear/stability
H5	**Horizontal/Vertical Wind Shear:**	Horizontal shear used
H6	**Mixing Layer**	**_✔_ trapping __ lofting __ reflection __ penetration** **__ inversion breakup fumigation _✔_ temporal variability**
H7	**Cloud Buoyancy**	**_✔_ neutral [passive] __ dense [negative] __ plume rise [positive]**
H13	**Temporally and Spatially Variant Mesoscale Processes**	**Urban heat island:** **Canopies:** **Complex terrain (land) effects: _✔_ mountain-valley wind reversals** **__ anabatic winds __ katabaic winds** **Complex terrain (land-water) effects: __ seabreeze airflow trajectory reversals** **__ Thermally Induced Boundary Layer definition __ seabreeze fumigation** **__ landbreeze fumigation** **Thunderstorm outflow:** **Temporally variant winds:** **High velocity wind phenomena: __ tornado __ hurricane __ supercane __ microburst**
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**	Predicts centerline concentrations/exposures.

J2	**Graphic Contours and Resolution**	Hand drawn pattern on areal map
J4	**Tabular at Fixed Downwind Locations**	Concentrations/exposures as function of time/distance with fixed locations indicated on maps.
J5	**Health Effects**	**__ toxicity indices [e.g., ERPG's, PAG's] _✔_ potential fatalities** **_✔_ cancers __ other adverse effects**
J6	**Number of People Affected, Calculated at What Resolution?**	**__ block __ block group _✔_ country**
J11	**Accuracy of Output, Calculated in Terms of Percentages of Population Impacted More Than Predicted at one, two, and three Standard Deviations in Urban and Rural Areas**	Unsheltered populations exposed externally and through inhallation - accuracy not defined, but centerline values considered "conservative'; i.e., values probably higher than most likely.
Part K: Model Usage Considerations		
K1	**Ease of Model Use**	**Training required to run the model:** _1 week_ **background (years of education)** _1 week_ **training time needed on the model to be able to exercise all model capabilities** **Training required to continue development of the model:** _1-2 years_ **background (years of education)** **__ training time needed on the model to be able to exercise all model capabilities**
K2	**Time to Process From Notification of Release (including data acquisition) to Production of Product Listed in #K1, Listed for Platforms for Which the Program is Already Compiled**	1 hour
K3	**Ease of Use of Output, Evaluated as the Time Needed to Train a College Graduate in the Use of the Output**	Tabular ouput easily interpreted and plotted - 1 week