| General Characteristics | | |
|---|---|---|
| 1 | **Abstract of Model Capabilities** | CONTAIN 1.2 is an integrated analysis tool used for estimating the physical, chemical, and radiological conditions inside a containment building following the release of radioactive material from the primary system in a severe reactor accident. It can also predict the source term to the environment. CONTAIN 1.2 is a highly flexible and modular code that can run problems that are either quite simple or highly complex. |
| 2 | **Sponsor and/or Developing Organization** | Nuclear Regulatory Commission (NRC) |
| 3 | **Last Custodian/ Point of Contact** | Mr. Richard Griffith<br>Organization 6421; MS-0739<br>P.O. Box 5800<br>Sandia National Laboratory<br>Albuquerque, NM 87185-0739<br>PHN: 505/844-8232 |
| 4 | **Life-Cycle** | CONTAIN Version 1.2 was developed from CONTAIN Version 1.1. Both versions of CONTAIN were developed by Sandia National Laboratory (SNL) for the NRC, for best estimate mechanistic containment analysis for severe accidents in nuclear reactors. Version 1.2 (the current version) was released in 1995. Although some maintenance continues, the NRC has released a position paper indicating that CONTAIN will not be developed further. |
| 5 | **Model Description Summary** | CONTAIN 1.2 is made up of a series of models that estimates the source term from a severe reactor accident. It has ventilation system, room/tank/glove box submodels, coupled to turbulence, species diffusion, and aerosol submodels. If necessary, spray models can be invoked to address this type of release scenario. |
| 6 | **Application Limitation** | See weaknesses. |
| 7 | **Strengths/ Limitations** | **Strengths:** Due to control volume approach, the code is fast-running and versatile. There is no limit to the number of flow path connections to a single control volume. Spray models are available if sprays are important to the analysis. Two-phase flow can be modeled if multi-phase flow is important to the analysis. The aerosol model, MAEROS, is a detailed mechanistic model. The code has been well assessed.<br>**Limitations:** There is no multi-dimensional capability. Disk overhead is associated with multiphase flow and reactor models. All subroutines appear to be loaded independently, or whether or not the models are activated. Limited fan/blower or filter models are available. Momentum balance ignores spatial acceleration term. |
| 8 | **Model References** | **!** D.E. Carroll et al, "Integrated Analysis of Core Debris Interactions and Their Effects on Containment Integrity Using the CONTAIN Computer Code", Nuclear Engineering and Design, Volume 104, 1987.<br>**!** D.C. Williams et al, "Containment Loads due to Direct Containment Heating and Associated Hydrogen Behavior: Analysis and Calculations with the CONTAIN Code", NUREG/CR-4896, 1987.<br>**!** K.D. Bergeron and D.C. Williams, "CONTAIN Calculations of Containment Loading of Dry PWR's", SAND84-1233J, Nuclear Engineering and Design, Volume 90, 1985. |
| 9 | **Input Data/Parameter Requirements** | **Data and input parameters:** Default gas properties are available for the following gas species: Hydrogen, Oxygen, Carbon Dioxide, Carbon Monoxide, Nitrogen, Methane, Helium, Argon, Deuterium, Iron vapor, Plutonium oxide vapor, Plutonium vapor, Sodium vapor, Uranium vapor, and Water vapor.<br>**Ventilation system components.** Input is via a free-field, key word-driven format. Physical models are activated only by the presence of associated key words in the input stream and are otherwise inactive. Most models allow the user to specify individual physical parameters. However, default values are available to the User. |
| 10 | **Output Summary** | Two basic types of time-dependent output written to the main output file are long edits and short edits. The presence or absence of much of the long-edit output is controlled by output keywords. In addition, the user can include user-implemented output writes. The user may access either global or cell level variables through the user-implemented output writes. Plot files are written that may be post processed by the POSTCON and HISPLOT computer programs or another user-provided post-processor program. |
| 11 | **Applications** | Applicable to any facility (i.e., buildings, tanks, single rooms, etc.) with and without ventilation systems for commercial industry nuclear reactors and DOE facility reactors. Applicable to multi-species gas mixing/transport problems, as well as aerosol transport problems. |

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|---|---|---|
| 12 | **User-Friendliness** | With the limited capability to model blowers/fans and filters, it will be difficult to use CONTAIN to simulate a typical hazardous material release within a typical DOE facility. |
| 13 | **Hardware-Software Interface Constraints/ Requirements** | CONTAIN is supported on the following platforms:<br><br>CRAY and UNIX Workstations (i.e., SUN, HP, IBM, and DEC). |
| 14 | **Operational Parameters** | No information provided. |
| 15 | **Surety Considerations** | **Quality Assurance:** Software Development Plan & Requirements - "Quality Assurance Procedures for the CONTAIN Severe Reactor Accident Computer Code", Sandia National Laboratories Report SAND90-011, NUREG/CR-5518, January 1991.<br><br>K.K. Murata et al, "User's Manual for CONTAIN 1.1: A Computer Code for Severe Nuclear Reactor Accident Containment Analysis", Sandia National Laboratories Report SAND87-2309, April 1993.<br><br>**Benchmarking and V & V:**<br><br>B.E. Boyack et al, "CONTAIN Independent Peer Review", Los Alamos National Laboratory Report LA-12866, January, 1995.<br><br>J. Dienstbier, "CUBE 1000: Benchmarking of CONTAIN, JERICO and MELCOR Codes Against Simple Thermal Hydraulic Problems", Nuclear Research Institute Rez, plc. Document UJV Z 13-T, August, 1994. |
| 16 | **Runtime Characteristics** | Typical execution time:<br><br>The ratio of real time to run time can vary from 0.5 to 100, depending on the modalization. |

**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<br><br>Aerosol releases: Yes.<br><br>Chemistry ✔ Isotopic exchange ✔ Physical properties capability |

**Part B: Dispersion Submodel Type** (Not Applicable)

**Part C: Transport Submodel Type** (No Information Provided.)

**Part D: Fire Submodel Type** (Not Applicable)

**Part E: Energetic Events Submodel Type** (Not Applicable)

**Part F: Health Consequence Submodel Type** (No Information Provided.)

**Part G: Effects and Countermeasures Submodel Type** (No Information Provided.)

**Part H: Physical Features of Model** (No Information Provided.)

**Part I: Model Input Requirements** (See Item 9.)

**Part J: Model Output Capabilities**

| | | |
|---|---|---|
| J10 | **Other** | Two basic types of time-dependent output written to the main output file are long edits and short edits. The presence or absence of much of the long-edit output is controlled by output keywords. In addition, the user can include user-implemented output writes. The user may access either global or cell level variables through the user-implemented output writes. Plot files are written that may be post processed by the POSTCON and HISPLOT computer programs or another user-provided post-processor program. |

**Part K: Model Usage Considerations** (No Additional Information Provided.)