ENVIRONMENTAL EMERGENCY RESPONSE PROGRAM FOR A UNITED STATES NUCLEAR MATERIALS FABRICATION FACILITY*

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INTRODUCTION

The Rocky Flats Plant is a United States Government-owned and contractor-operated facility. It is part of a nationwide nuclear materials research, development, and production complex administered by the U.S. Department of Energy (DOE). The operating contractor for the Rocky Flats Plant is the Energy Systems Group of Rockwell International. Operations at the Plant include fabrication and assembly of weapons components from plutonium, uranium and beryllium. Chemical recovery and purification of process-produced transuranic radionuclides, fissile material studies, and critical assembly experiments also are conducted. Due to these operations, emergency response to accidental releases of airborne or waterborne effluents may be critical to avert any significant health impact. This paper describes the environmental emergency response program for the Rocky Flats Plant.

PLANT GEOPOLITICAL SETTING

The Rocky Flats Plant is located 26 kilometers from Denver, Colorado, whose population exceeds one million people. The site consists of 2,650 hectares of federally owned land. Typical air flow patterns are toward the metropolitan area. Plant surface water flows into two downstream drinking water reservoirs.

The natural environment of the Plant site is influenced by the Front Range of the Rocky Mountains and is characterized by dry, cool winters and warm, somewhat moist summers. There is considerable clear-sky sunshine. The average precipitation and relative humidity are low. Area hydrology is influenced by gravelly and highly permeable alluvium topsoil. Water retention in this soil is poor, and vegetation is sparse. These features produce harsh, semiarid conditions. Winds at Rocky Flats, although variable, are predominantly westerly, with strong winter winds. A description of the facility and its impact on the surrounding environment is given in the Environmental Impact Statement.[1]

The environs are routinely monitored for ionizing radiation and for pertinent radioactive, chemical, and biological pollutants. Air, water, soil, and vegetation are sampled on the Plant site and throughout the surrounding region. The results of these tests are reported in an Annual Environmental Monitoring report.[2] Several Federal, State, and Local governmental agencies independently conduct additional environmental surveys on and off the Plant site.

Monthly environmental data exchange meetings are held with the Colorado Department of Health (CDH). Government health officials at all levels, interested citizens, and the news media may attend this meeting. These meetings provide the opportunity to document results of monitoring programs,[3, 4] and for public discussion regarding reported levels of various materials associated with

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the Rocky Flats Plant. Special discussion topics include analytical procedures, calculational methods, new and ongoing construction projects at the Plant, and health effects studies. This ongoing interface with the State of Colorado and others provides a positive means to promote cooperative actions and to enhance public communications.

EMERGENCY RESPONSE PLANS AND CAPABILITIES

Rocky Flats has comprehensive emergency plans that provide guidance and procedures designed to protect life and property within the facility, the health and welfare of surrounding metropolitan communities, and the defense interests of the nation during any credible emergency situation. Mutual assistance and coordination with Federal, State, and Local agencies is assured on a cooperative basis. Periodically, Plant scientific staff, in conjunction with personnel from the CDH, conduct a complete review of the Plant's defined Maximum Credible Accident (MCA). The purpose of this review is to ensure the current adequacy of the MCA for emergency response planning. The MCA is defined as the accident of highest consequence that can reasonably be expected to occur. A lower limit probability value of 1×10^{-7} per year was selected as a cutoff value on accidental releases of radioactivity for which the Plant would prepare. Accidents with a lower probability were not considered credible. The MCA event identified for the Rocky Flats Plant postulates a large, fully fueled aircraft crashing into one of the plutonium processing buildings. The consequence of this MCA is a possible plutonium release of 100 grams.

Other events were considered. Natural phenomena providing the greatest potential hazards were earthquakes, tornados, and extreme winds. Concurrent or event-precipitated accidents, such as fire and explosion following an earthquake, were evaluated. Operational accidents were analyzed based on estimated probability of occurrence and associated quantity and physical properties of material released. Leak path and dispersion analyses were used to predict the potential material release from buildings. All other events were found to be of lesser consequence.

The Rocky Flats Emergency Plan is designed for response to all postulated accidents.[5] The plan includes integration of local, state and federal emergency response agency plans. The plan provides guidance during emergencies and for recovery to normal operations and directs that the Plant be as self-sufficient as possible in handling emergencies. During an emergency, a cadre of management assemble at the Plant Emergency Operations Center (EOC) to implement the plan. The EOC is equipped with radio, telephone, and closed circuit television communications systems.

Emergency support services at the Plant include a medical facility, analytical laboratories, fire department, security department and service garage. Teams of health physicists, industrial hygienists, safety engineers and environmental engineers are available to direct actions to minimize and control any emergency.

For environmental control and assessment, the Plant operates a routine environmental surveillance program that includes building air effluent sampling, an ambient air sampling network, and water and soil sampling programs. Surface water is contained and controlled by a series of retention ponds. Additionally, gas operated generators, portable air samplers, portable meteorological stations, radiation monitoring instruments, a four-wheel drive pickup truck and an all-terrain vehicle are available for emergency use.

Meteorological data are obtained from several onsite meteorological stations and from a computer-accessed regional 16-station network. Using the site-observed meteorological data, localized impact is estimated with a straight-line Gaussian model.

Due to complex terrain at the Plant, spatially and temporally changing windfields are produced resulting in nonlinear, time-dependent plume trajectories. Therefore initial regional modeling is

conducted utilizing computer assessed real-time meteorological data from the regional meteorological monitoring stations. These data are hand charted on a topographic overlay of the surrounding region. Standard streamline/isotach analysis of the data then results in a nonlinear trajectory that projects downwind arrival time for the plume. Further site specific regional modeling is conducted using a government-supported nationwide service entitled Atmospheric Release Advisory Capability (ARAC).[6] The ARAC system consists of a central computer facility at the Lawrence Livermore National Laboratory in California. Local, regional and global meteorological data and pollutant release rate information are evaluated by a three-dimensional, particle-in-cell transport and diffusion computer code. The code incorporates the effects of stratified shear flows, calm conditions, variable regional topography and wet and dry deposition rates and calculates atmospheric concentration, ground deposition and radiation dose. This information is transmitted to a local computer system and is available on a CRT screen and as a printed copy. ARAC projections are useful during prolonged emergencies, for post-emergency guidance and for accident evaluation.

In addition to the Plant response capabilities, the DOE has nationwide and regional radiological assistance plans in which the total resources of the DOE and its contractors can be called upon.

If an incident at the Plant is perceived to endanger the health and safety of the general public, the Colorado Radiological Emergency Response Plan for Rocky Flats[7] would be activated. This plan has been developed through agreements with the State of Colorado, county and city governments, the DOE, and Rockwell International. Coordination of emergency activities in the public sector is controlled by the Governor of the State of Colorado and coordinated through the State Division of Disaster Emergency Services.

Exercises of the Plant and State Emergency plans and procedures are conducted periodically to ensure that emergency response teams remain fully trained and ready to handle emergency situations. Exercises have included the participation of offsite emergency support groups. Post test critiques are conducted to determine efficiency and to modify procedures as required.

ENVIRONMENTAL EMERGENCY RESPONSE ACTIVITIES

The Environmental Analysis (EA) Emergency Response Team supports all emergencies with potential for accidental airborne or waterborne emissions of radioactive or chemical substances. This Team consists of a response coordinator, recorder, communications person, meteorologist, health physicist and environmental engineers.

Notification of a potential emergency is obtained through a dedicated telephone alarm system. Within 10 minutes of notification, the EA Team is assembled, manpower assignments are made in accordance with a pre-established check sheet and communications are established with the Plant EOC. Within 15 minutes, information on current weather data, potential geographic impact area, Gaussian and nonlinear plume trajectories, and initial health impact estimates are determined and forwarded to the EOC. If the emergency is determined to be real and involves the potential for abnormal airborne discharges, the ARAC Central Facility is activated and site specific regional models of the plume are available within 45 minutes to two hours. Additionally, analytical laboratories are alerted and a check is made to determine that the surface water control dams are all closed. During the duration of the emergency, communications with the EOC continue with 15-minute EA Team action updates. Information is periodically obtained from the EOC regarding the status and magnitude of the emergency.

Field activities during the first hour include a physical check of the dams and routine air samplers and, as deemed necessary, generator-powered supplementary portable air samplers and a meteorological tower are established at strategic locations.

After termination of the emergency, an environmental sampling plan is established, samples are collected and analyzed, and the final impact is assessed. Also a post emergency critique is conducted.

In conclusion, the Rocky Flats Environmental Emergency Response plan is a viable, workable, and tested plan that is designed to define and/or avert adverse environmental impact.

REFERENCES

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