**WIPP Site Incident Independent Review Team (WSIIR)**

**7/29/15 Meeting Recap with**

**Los Alamos National Laboratories WIPP Incident Investigation Group**

# Introduction

The WIPP Site Incident Independent Review (WSIIR) team met with the Los Alamos National Laboratories (LANL) WIPP incident investigation group at LANL on July 29, 2015. The purpose of the meeting was for LANL to present detailed findings of their WIPP incident investigation. LANL’s April 02, 2015 report, upon which their presentation content was based, is available on our website: [www.nmt.edu/WSIIR](file:///C%3A%5CDocuments%20and%20Settings%5CJulie%5CLocal%20Settings%5CTemp%5Cwww.nmt.edu%5CWSIIR)

In this document we summarize the most salient points from the July 29th meeting and present our team’s interpretation of LANL’s findings.

# Overview of LANL Investigation into WIPP Incident

LANL’ investigation began in the Spring of 2014. Two teams were tasked with the investigation: one team focused on analyzing the role of the Swheat mixture (referred to elsewhere in this report as organic kitty litter) in the ruptured drum; the other team took a broader focus of the entire incident. These teams reached consistent conclusions throughout their investigation and eventually merged into one team. The charge of this team was as follows:

* to properly understand the February 14, 2014 event
* to render a technical opinion of the event and of the restart of WIPP operations
* to make recommendations on how to avoid a similar event from occurring

The ruptured drum, drum #68660 was part of 720 drums that originated from LANL that contained the organic kitty litter. Sixty of those drums remain at LANL and are being watched for a possible breach. Approximately 100 are located at Waste Control Specialists LLC, a facility in Andrews, TX, buried 90 feet below the ground. The remainders are at WIPP, with the majority housed in Panel 6 and 55 drums located in Panel 7.

Both LANL teams (before they merged) focused their investigation on the chemistry of the event. They considered four areas related to the breach of drum #68660:

1. Changes in waste processing procedures
2. Possible triggers for unstable nitrate sale-fuel mixtures
3. Radiation chemistry
4. Trace metal impurities

From their investigation of these particular areas, they concluded that adding organic kitty litter as well as other steps taken by glovebox technicians introduced unstable chemical mixtures into the drums to be stored at WIPP. An unidentified trigger then initiated a runaway exothermic reaction which caused drum #68660 to breach.

# Key Findings Presented by LANL

1. The mixture of nitrate salts and organic kitty litter created the potential for an exothermic reaction.
2. In experimental test runs, high temperatures (160-330° C) and a sealed drum were required for similar mixtures to react uncontrollably.
3. A chemical model of a drum with contents similar to drum #68660 confirm the drum should have breached.
4. LANL (not TAT) believes that nitrates + Swheat + water can generate heat which can result into an initial temperature raise of 60° C. This initial temperature is high enough to trigger further exothermic reaction and exponential increase in pressure and temperature.
5. The environmental signature at WIPP is consistent with the tests on smears from the breached drum, suggesting that the drum #68660 was the only drum that breached.
6. No two drums are the same due to heterogeneity. This could be the reason that one drum breached but not the rest; LANL Cheetah modeling shows that runaway time is highly dependent upon the variables involved.
7. Except for some minor differences, LANL and TAT have similar conclusions regarding the cause of the breach.

Complex mixtures of metal ions (Fe and Mg in particular) can generate NO**2**, facilitating the nitration of the organic kitty litter. These complex mixtures can produce exothermic behavior at a temperature as low as 60° C (140° F). A glovebox glove which contained Bismuth (Bi) generated a vigorous exothermic reaction with the mixture in the drum 68660. Spontaneous self heating from biological activity (ie: molds or yeast), initial high acid concentration, presence of reactive metals, glovebox glove may have been the triggers.

LANL concluded the most likely scenario of the February 14, 2014 incident was that the combination of nitrate salts and organic kitty litter created a temperature-sensitive mixture with the potential for a runaway exothermic reaction. The drum contents of #68660 generated increased temperature and pressure, leading to failure of the drum**.** It did not require an internal heat source for the drum to breach.

The team at LANL drew these conclusions from monitoring the headspace gases of all 60 remaining drums at LANL. They modeled the chemistry of the drums and sampled the atmosphere of the secondary container around the drums.Slides devoted to modeling (computational fluid dynamics), analysis of the chemistry of drum contents, and drum sampling from the parent drum (the drum still at LANL that #68660 originated from) provided specific information about LANL’s investigative process and their arrival of these conclusions.

# WSIIR Team Assessment to Date

1. Uncertainty exists regarding remaining drums with Swheat (organic kitty litter) breaching.
2. In order to react, these drums would need a significant heat source.
3. If these drums are kept cool enough, the potential for them to have a runaway reaction is very low.
4. Radionuclides did not play a significant role in the runaway reaction that happened Feb. 14, 2014
5. Neither the TAT nor LANL found any relationship between the truck fire and the rupture of drum #68660. It is plausible that these events are unrelated.
6. While safety procedures are already in place, safety must be made a higher concern at WIPP going forward.

# Path Forward

As our July 29, 2015 meeting was focused on LANL’s presentation of their investigation and conclusions, time did not permit a complete discussion of LANL’s recommendations for path forward. We will meet with LANL this Fall for a meeting devoted specifically to path forward.