LOWER MILLER CREEK
CUMULATIVE HYDROLOGIC IMPACT
ASSESSMENT
(CHIA)

For

COVOL Engineered Fuels, LLC
Wellington Dry-Coal Cleaning Facility
C/007/0045

In

Carbon County, Utah

August 31, 2009
TABLE OF CONTENTS

I. INTRODUCTION

II. CUMULATIVE IMPACT AREA (CIA)

III. HYDROLOGIC SYSTEM AND BASELINE CONDITIONS
   a. GEOLOGY
   b. CLIMATE
   c. HYDROLOGY
      i. Groundwater
      ii. Surface Water

IV. HYDROLOGIC CONCERNS AND ASSESSMENT OF MATERIAL DAMAGE TO THE HYDROLOGIC BALANCE
   a. Contamination from Acid- or Toxic-forming materials
   b. Increased Sediment Yield From Disturbed Areas
   c. Impacts to Groundwater Availability
   d. Impacts to Surface Water Availability
   e. Increased TDS Concentrations
   f. Flooding or Streamflow Alteration
   g. Hydrocarbon Contamination

V. STATEMENT OF FINDINGS

VI. REFERENCES
I. INTRODUCTION

The Cumulative Hydrologic Impact Assessment (CHIA) is mandated by Section 510(b)(3) of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). It is part of the permit approval process, documenting that all anticipated mining in the area has been designed to prevent material damage to the hydrologic balance outside of the permit area. Before a permit can be approved, the regulatory authority (RA) must conduct an assessment of the cumulative hydrologic impacts of all anticipated mining on the hydrologic balance in the cumulative impact area (CIA) and must find that the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area. The CHIA is not only a determination as to whether a coal mining operation has been designed to prevent material damage beyond it’s respective permit boundary, but also a determination that the cumulative effects of additional coal mining operations in the area will not result in material damage to the hydrologic balance outside the respective permit areas.

The following CHIA has been prepared for Covol Engineered Fuels, LLC Wellington Dry-Coal Cleaning Facility (Covol Facility). The Covol Facility is located approximately 7 miles south south-east of Price, UT (See Figure 1- General Location). The Covol Facility is located within a sub-watershed of Miller Creek. Miller Creek is a small, perennial tributary to the Price River. A CIA encompassing a portion of this sub-watershed has been delineated and analyzed in the preparation of this CHIA (See Figure 2- Cumulative Impact Area Location). The CIA is approximately 193 acres and located within T16S R10E Sections 13, 14, 23 and 24. Two small ephemeral tributaries to Miller Creek are located south of the permit area.

The Covol Facility is not a mining operation, but rather a coal cleaning facility that utilizes an air-jig separation method to process coal-bearing materials. The entire coal cleaning process takes place above ground with no associated underground/sub-grade disturbance. The sources of coal at the Covol Facility are obtained from the Book Cliffs, Wasatch Plateau and Emery Coal Fields, which historically have not produced acid or toxic coal. The Covol Facility is 30 acres in size.

The objective of the CHIA document is to:

1. Identify the Cumulative Impact Area (CIA) (Part II)
2. Characterize CIA Baseline Conditions; (Part III)
3. Identify Hydrologic Concerns and Assess the Potential for Material Damage (Part IV)
4. Prepare a Statement of Findings (Part V)
5. Provide References (Part VI)
This CHIA complies with the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA) and subsequent federal regulatory programs under 30 CFR 784.14(f), and with Utah regulatory programs established under Utah Code Annotated 40-10-et seq. and the attendant State Program rules under R645-301-729.

II. CUMULATIVE IMPACT AREA (CIA)

The CIA is approximately 193 acres and located within T16S R10E Sections 13, 14, 23 and 24. Figure 2- Cumulative Impact Area Location delineates the CIA for current and projected mining in the Lower Miller Creek watershed area. A CIA encompassing a portion of a sub-watershed of Miller Creek has been delineated and analyzed in the preparation of this CHIA. The CIA includes a portion of Miller Creek as a hydrologic resource that could be potentially impacted by proposed and anticipated coal mining activity. Ground and surface water resources within the area were analyzed and evaluated in producing the CIA for the Covol Facility.

The CIA is approximately 193 acres and located within T16S R10E Sections 13, 14, 23 and 24. Two small ephemeral tributaries to Miller Creek are located south of the permit area. No surface water features are located within the permit area. In addition, no springs or domestic/industrial use water wells have been identified within the permit area.

The entire permit area (30 acres) for the Covol Facility is located within this lower portion of the Miller Creek Watershed. A hydrologic/watershed boundary is located north of and directly adjacent to the Covol Facility. This boundary represents a hydrologic separation between what has been identified within this CHIA as the Lower Miller Creek Watershed (See Figure 2- Cumulative Impact Area Location) and the adjacent Price River Watershed to the north.

Based upon a review of area topography, the watershed directly north of the Covol Facility reports directly to the Price River. Within this watershed, the Savage Coal Terminal is located approximately 0.4 miles north-west of the Covol Facility. The Savage Coal Terminal is currently operating under a SMCRA permit (C/007/0022) and a CHIA was prepared in August, 1989. The Savage Coal Terminal previously operated under the title of C.V. Spur Coal Processing and Loadout Facility. The Savage Coal Terminal prepares/washes raw coal that is incapable of meeting contract specifications in its natural state (i.e. high ash content).

The Savage Coal Terminal is located within the Price River Watershed (as the Covol Facility), but is not contained within the Lower Miller Creek CIA. Though the Savage Coal Terminal is located in close proximity to the Covol Facility (approximately 0.4 miles north-west), the potential for a cumulative hydrologic impact from the two facilities is minimal. As a result, the Savage Coal Terminal was not included within the CIA for the Covol Facility. A more detailed discussion is provided below in the Hydrologic Concerns section.

At this time, no other coal mining related activities are proposed and/or anticipated within the Lower Miller Creek Watershed and delineated CIA.
III. HYDROLOGIC SYSTEM AND BASELINE CONDITIONS

The climatic, soil and geologic conditions of the CIA, which affect and determine the hydrologic characteristics, are described below. Discussion of the ground and surface water systems follow under separate headings.

CLIMATOLOGICAL INFORMATION

Based upon climate data obtained from the Western Regional Climate Center, normal annual precipitation at the permit area is approximately 9 inches per year. Due to the relatively low amount of annual rainfall, the CIA is considered semi-arid. Surface elevations in the area range from approximately 5,530 to 5,500 feet above sea level.

Average annual wind speed data (as obtained from the Price, Utah airport) is reported at 6.8 miles per hour (mph).

Average annual temperature for the area is approximately 49.9 degrees Farenheit. Temperature variation is considerable with a normal monthly low of 13.4 degrees Farenheit reported for January to a normal monthly high of 90.0 degrees Farenheit for the month of June (Western Regional Climate Center data).

SOIL INFORMATION

The Covol Facility is located in central Utah in the lowland area south of the Book Cliffs and north of the San Rafael Swell. The dominant surficial geologic formation within the CIA is the Mancos Shale. The member of the Mancos Shale found predominantly at the Covol Facility is the Blue Gate member which is comprised of primarily shales, siltstones and minor sandstone bedding.

Upon review of the Soil Survey of Carbon County (Jensen and Borchert, 1988), the Covol Facility is located on soils identified as the Persayo-Chipeta Complex with some Killpack Clay Loam soils located on the permit areas eastern edge.

The Persayo-Chipeta Complex is characterized by a light brownish-grey, shallow, well-drained soil that formed in shale. Permeability is considered slow to moderately slow. The potential for water erosion is moderate to high and the potential for blowing soil is considered moderate. Agricultural use of the Persayo-Chipeta Complex is not considered practical due to its fine texture and the areas low amount of annual precipitation (Jensen and Borchert, 1988).

The Killpack Clay Loam is characterized by a grayish-brown, moderately deep, well-drained soil that formed as residual of shale. The permeability of the soil is characterized as slow. The potential for both water erosion and blowing soil are moderate. As with the Persayo-Chipeta Complex, revegetation/agricultural applications on the Killpack Clay Loam is not considered practical due to its fine texture and the areas low amount of annual precipitation (Jensen and Borchert, 1988).
GEOLOGY INFORMATION

The Covol Facility is located in Castle Valley, approximately 3.5 miles west of the town of Wellington, UT. To the north and east of Castle Valley lie the Book Cliffs. The San Rafael Swell borders the valley to the south with the Wasatch Plateau adjacent on the west side. Castle Valley is characterized as a broad plain with several drainages dissecting it.

The surficial geology of the Covol Facility and adjacent area is predominantly the Blue Gate Member of the Mancos Shale. The Blue Gate Member of the Mancos Shale consists of light bluish gray and gray thin-to medium-bedded shale and shaly siltstone with interlayered sandstone beds. The Blue Gate Member unit is relatively impermeable and contains a high gypsum content. (Weiss et al., 1990). According to Weiss et al. (1990), the Covol Facility is constructed primarily on Quaternary slope wash and weathered material from the Blue Gate Shale Member of the Mancos Shale. This unit is up to 2,000 feet thick in the region, but estimated to be approximately 700 feet thick beneath the Covol Facility and adjacent area. (Weiss et al., 1990).

The upper Mancos is an extremely effective confining unit because of its great thickness and continuity of impermeable shale and siltstone units (Gloyn et al., 2003). Direct precipitation on outcrops of the Ferron Sandstone and infiltration from streams are sources of recharge to the aquifer, particularly in the Castle Valley area (Gloyn et al., 2003). The potentiometric surface of the aquifer indicates that the primary recharge area to the Ferron aquifer is from the west.

Well logs from nearby gas production wells (DOGM, 2007) indicate that the Blue Gate Shale Member is underlain by the Ferron Sandstone Member at depth of approximately 700 feet beneath the site. The Ferron Sandstone Member of the Mancos Shale is comprised of an upper and a lower sandstone unit with a middle unit of shale (Hintze, 1988). The sandstones are typically light brown, thin and even bedded, cross-bedded, very fine grained to fine-grained sandstone and contain large rounded concretions (Weiss et al., 1990).

HYDRAULIC CONDUCTIVITY

All of the rock units in the vicinity of the Covol Facility are sedimentary (Hintze, 1988). In sedimentary rocks, there is a wide range of textures or fabrics that determine the hydraulic characteristics of the unfractured medium. These textures or fabrics are related to the mineralogy or composition of the sediments, the range of sizes of the sedimentary particles (sorting), the spatial distribution of different sediment-sizes (grading), the shape and spatial orientation or arrangement of the sediment particles after compaction (packing), cementation and properties acquired or altered as the sediments were lithified (Hintze, 1988).

According to Gloyn et al. 2003, shales are characterized as semi-permeable to impermeable with hydraulic conductivity values of $10^{-8}$ to $10^{-3}$ feet/day. These values are representative of the hydraulic conductivities of the Blue Gate Members of the Mancos Shale present at the Covol Facility.
HYDROLOGIC RESOURCES

The CIA is located in the Price River Watershed. The Covol Facility is approximately 0.40 miles from Miller Creek (a small perennial tributary to the Price River). No ground or surface water resources are located within the permit area of the Covol Facility.

Ground Water

Based upon data and well logs obtained from the Savage Coal Terminal located approximately 0.4 miles west of the Covol Facility, groundwater is potentially located in the shallow, perched Quaternary deposits above bedrock and in the Ferron Sandstone Member of the Mancos Shale (which is located approximately 700 feet below the surface of the permit area). A Bluegate Shale Member of the Mancos Shale separates these two potentially water-bearing units. As discussed in the geology section above, the Bluegate Member of the Mancos Shale is highly impermeable thus greatly reducing the vertical migration of ground water. The upper Mancos is an extremely effective confining unit because of its great thickness and continuity of impermeable shale and siltstone units (Gloyn et al., 2003).

Perched ground water may occur in the area of the Covol Facility in disconnected, unconsolidated materials that overly relatively impermeable bedrock. These ground water resources are primarily recharged via precipitation, infiltration from losing stream reaches and flood irrigation practices in the area. (Gloyn et al., 2003).

Groundwater in these units are generally of poor quality with high total dissolved solid concentrations (TDS) (Gloyn et al., 2003). Based upon ground water monitoring data obtained from the nearby Savage Coal Terminal, ground water samples typically produce TDS levels well over 2,000 mg/L (DOGM, Electronic Water Monitoring Database 2009).

Surface Water

The Covol Facility is approximately 0.40 miles from Miller Creek. The topography of the area drains southward to Miller Creek. The site is predominantly flat with little topographic relief. No surface water resources are located within the permit area. Drainage of the area occurs as overland flow or in ephemeral drainages that flow in direct response to precipitation event and/or snow melt. Two ephemeral drainages that report to Miller Creek are located adjacent to the southern portion of the permit area. One of the ephemeral drainages is approximately 400 feet west of the south-west corner of the permit area. The other ephemeral drainage is located approximately 0.35 miles south-east of the south-east corner of the Covol facilities permit area.

Miller Creek is a small perennial stream that intercepts the Price River in Wellington, Utah. Historical stream gage data is not available for Miller Creek.

IV. IDENTIFY HYDROLOGIC CONCERNS

In this section, potential hydrologic impacts/concerns to ground and surface water
resources as a result of the Covol facilities operations are discussed.

As the Covol Facility is strictly a surface, coal cleaning operation, potential impacts to hydrologic resources differ from that of an underground coal mining operation. The following are potential impacts that operations at the Covol Facility could produce:

- Contamination from acid- or toxic-forming materials;
- Increased sediment yield from disturbed areas;
- Impacts to groundwater availability;
- Impacts to surface water availability;
- Flooding or streamflow alteration;
- Hydrocarbon contamination from above ground storage tanks or from the use of hydrocarbons in the permit area.

The following is a discussion of these impacts and the measures that have been implemented to minimize the potential for causing material damage to the hydrologic balance.

**CONTAMINATION FROM ACID- OR TOXIC-FORMING MATERIALS**

The Covol Facility processes material received from off-site clients. This material may have once been classified as coal mine waste or coal processing waste from it’s origin. However, the Covol Facility processes all material brought onto the site into one of two (or both) products: high-quality coal and/or low-quality (low-BTU) coal. The product is then shipped off-site in accordance with contract requirements. No material brought on site is stored for indefinite periods of time. The Covol Facility performs testing of any material to be brought on site prior to it’s arrival. If the material can not be processed into one of the aforementioned final products, it is rejected and not brought to the site.

The potential for the coal product stored at the site to produce contamination from acid- or toxic-forming materials is minimal. The sources of coal at the Covol Facility are located in the Book Cliffs, Wasatch Plateau and Emery Coal Fields. These coal seams have historically not produced acid or toxic coals. In addition, the coal is only temporarily stored at the facility, the native soils in the permit area are alkaline and sediment precipitation runoff is controlled by drainage ditches and two large sedimentation ponds. As a result, the potential for acid- or toxic-forming contamination migrating off the disturbed area is minimal.

As an additional safety measure, the Permittee commits to sampling all coal and coal waste that remains on site after an inactive period of 30 days. The Permittee will collect one sample for every 2,000 cubic yards of the on-site material, composite the samples and have the sample analyzed for acid- and toxic-forming materials in accordance with Tables 7 and 8 of the Division’s Guidelines for the Analysis of Topsoil and Overburden. Any material that is verified to contain acid- and toxic-forming materials will be processed within one month following the receipt of the verifying analyses.

Given the impermeable nature of the surficial geology, the historic lack of acid producing
coal in the Book Cliffs, Wasatch Plateau and Emery Coal Fields, the limited ground water

resources in the area and the stormwater runoff measures implemented at the site, the potential
for material damage to the hydrologic balance from acid- and toxic-forming materials is
negligible.

INCREASED SEDIMENT YIELD FROM DISTURBED AREAS

As the site of the Covol Facility was previously un-developed prior to the acquisition by
the Permittee, the site was disturbed and extensive earth work performed during the construction
of the site. As a result, increased sediment yield from the disturbed area has the potential to
impact hydrologic resources down gradient from the site.

The Covol Facility utilizes a series of diversion channels, sedimentation ponds,
containment berms, silt fences and road diversions and culverts to route and handle stormwater
runoff from the disturbed area. These sediment controls have been designed and constructed to
prevent additional contributions of sediment to streams or to runoff outside the permit area.

Two sediment ponds have been constructed on the southern portion of the permit area.
The ponds are designed to work individually. One pond receives the drainage from the eastern
portion of the disturbed area while the other pond receives the runoff from the western portion of
the disturbed area. The ponds have been designed to fully contain the stormwater runoff from a
10-year, 24-hour precipitation event. Based upon Universal Soil Loss Equation calculations
provided in the MRP, the east and west sediment ponds have been constructed to store 16,930 and
12,730 cubic feet of sediment respectively. These volumes of sediment correspond to
approximately 51 to 95 years of average annual sediment storage for the east and west ponds
respectively.

The topography of the area slopes to the south. In order for sediment to reach one of the
ephemeral tributaries to Miller Creek, the sediment ponds would have to discharge. The
discharged sediment would then have to travel overland approximately 400’-500’ prior to being
deposited into the nearest ephemeral drainage that reports to Miller Creek.

As a result of the robust design and construction specifications of the sediment ponds, the
unlikelihood of the ponds discharging and the distance the sediment would need to travel before
encountering a surface water resource, the potential for material damage to the hydrologic balance
from increased sediment yield outside of the permit area is minimal.

IMPACTS TO GROUNDWATER AVAILABILITY

As outlined previously, the Covol Facility’s operation is a dry, coal cleaning operation that
utilizes an air jig separator to produce a final product. The operation is conducted above ground.
No underground mining or excavation will be conducted at the site. As a result, impacts to
groundwater availability are negligible.

Regional hydrogeologic information indicates that the extent of groundwater in the area of
the Covol Facility is limited. In addition, the Covol Facility is located upon an approximately 700
foot thick layer of Mancos Shale. As previously discussed, the upper Mancos is an extremely effective confining unit because of its thickness and continuity of impermeable shale and siltstone units (Gloyn et al., 2003). The result of which is very limited groundwater resources in the area of the Covol Facility. Groundwater monitoring wells at the Savage Coal Terminal, located approximately 0.25 miles north of the Covol Facility, were constructed from 6 to 20 feet deep into this material. Water samples obtained from these wells often produced TDS (Total Dissolved Solids) values well over 2,000 mg/L (Savage Services Corporation MRP, 1983).

Based upon well logs from nearby gas production wells (DOGM, 2007), the other aquifer system identified in the region of the Covol Facility is the Ferron Sandstone which is located approximately 700 feet below the site. The Ferron Sandstone Member of the Mancos Shale is comprised of an upper and a lower sandstone unit with a middle unit of shale (Hintze, 1988). The sandstones are typically light brown, thin and even bedded, cross-bedded, very fine grained to fine-grained sandstone and contain large rounded concretions (Weiss et al., 1990). According to Gloyn et al., 2003, sources of recharge to the Ferron aquifer system, particularly in the Castle Valley area are from direct precipitation on outcrops and infiltration from streams.

No water supply wells are located within the permit or adjacent areas. The dominant surficial geology contains minimal amounts of groundwater and it’s physical characteristics impede vertical groundwater flow. Furthermore, the minimal groundwater that is located in the area is of very poor quality. As a result, the potential for material damage to groundwater availability, due to the operation of the Covol Facility, is minimal.

**IMPACTS TO SURFACE WATER AVAILABILITY**

No surface water resources are located within the permit area of the Covol Facility. A small ephemeral tributary to Miller Creek is located approximately 400 feet west of the south-west corner of the permit area. A second ephemeral drainage reporting to Miller Creek is located approximately 0.35 miles south-east of the south-east corner of the Covol Facility’s permit area.

Miller Creek is located approximate 0.4 miles south of the Covol Facility. The topography of the Covol Facility drains to the south toward Miller Creek. The Price River is located approximately 2 miles northeast of the Covol Facility.

Two surface water rights are located on Miller Creek, south of the Covol facility (#91-3294 and #91-3295). They are approximately 0.4 to 0.5 miles from the site. Both of the water rights are for stockwatering directly on the stream.

The operations at the Covol Facility consist of a dry, air separation system whereby the coal is processed without the use of chemicals and/or water. The Covol Facility does not divert or utilize surface water resources in their coal processing operation.

As there are no surface water resources on the site, the operations of the facility are above ground and water is not utilized in the processing of the coal, there is minimal potential for material damage to surface water availability as a result of the Covol Facility’s operation.
**FLOODING OR STREAMFLOW ALTERATION**

The Covol Facility and it’s disturbed area runoff are isolated from the adjacent area by utilizing a series of runoff control structures such as berms, diversion ditches and sedimentation ponds. All stormwater runoff generated on the site is routed to one of the two sedimentation ponds. The ponds are designed for total containment of the design storm event (10-year, 24 hour). As previously discussed, the Covol facility is approximately 0.4 miles from Miller Creek.

In summary, the Covol Facility’s potential to produce material damage from flooding or streamflow alteration impacts is remote due to the absence of mining or exploration occurring at the site, the lack of surface water resources within the permit area and the utilization of over-designed sedimentation ponds to control stormwater runoff.

**HYDROCARBON CONTAMINATION FROM ABOVE GROUND STORAGE TANKS OR FROM THE USE OF HYDROCARBONS IN THE PERMIT AREA**

Diesel fuel, oils, greases and various other hydrocarbon products are stored and utilized at the Covol Facility for a variety of purposes. Any storage of these types of chemicals produces the potential for spills and/or leaks.

As part of the Covol Facility’s permitting process, a Spill Prevention, Control and Countermeasure Plan (the Spill Prevention Plan) was developed, submitted and approved by the Department of Environmental Quality per the Clean Water Act. The plan outlines the various chemicals and containment practices that will be employed at the facility.

The diesel fuel is stored in an above-ground storage tank that is equipped with secondary containment. Additionally, tanks and drums of other products are stored in secondary containment structures that prevent leaks from reaching the ground. The Spill Prevention Plan indicates that: equipment maintenance will be taken care of offsite, used oil will not be accumulated on-site and no underground storage tanks will be utilized at the facility.

In addition to the secondary containment structures that will be utilized on the site, the stormwater runoff system would prevent hydrocarbon products from leaving the area as the result of a spill or release. For these reasons, the potential for material damage to hydrologic resources from hydrocarbon contamination is minimal.

**CUMULATIVE EFFECTS**

The Savage Coal Terminal and the Covol Facility are both located within the Price River Watershed and are in close proximity to one another. The two facilities are separated by a ridgeline that defines a hydrologic boundary. The result of which is that the Savage Coal Terminal and the Covol Facility are located in two separate sub-watersheds of the Price River despite their close proximity to one another (approximately 0.4 miles). The sub-watershed that the Covol Facility is located in drains south towards Miller Creek. The Savage Coal Terminal’s
topography drains north towards the Price River. As a result, the potential for the two facilities to produce a cumulative effect on hydrologic resources is minimal.

Due to the general lack of groundwater resources in the surrounding areas, the absence of underground mining and/or exploration and the impermeable nature of the surficial geology at both facilities, the potential for cumulative material damage to groundwater resources is minimal.

The most probable cumulative hydrologic impact produced from the Covol Facility and the Savage Coal Terminal would be an increase in sedimentation and/or contamination to the Price River. However, the likelihood of such an impact occurring is negligible.

As previously discussed in this document, in order for any contamination or sediment to leave the Covol Facility, the sedimentation ponds (designed for full containment of the 10-year, 24-hour rainfall event) would need to discharge a significant amount of water. The volume of that discharge would have to be significant enough to flow overland over 500’ before reaching the nearest ephemeral tributary to Miller Creek. Once that discharge entered Miller Creek, it would have to travel over 12 miles before reaching the Price River. The point at which Miller Creek intercepts the Price River would be the closest point at which the Covol Facility and the Savage Coal Terminal could potentially produce cumulative material damage to a hydrologic resource (i.e. the Price River).

As a result, the Division finds that the potential for the Covol Facility and the Savage Coal Terminal to produce a cumulative impact to hydrologic resources is minimal.

V. STATEMENT OF FINDINGS

Based on the information presented in this CHIA, the Utah Division of Oil, Gas and Mining finds that the proposed coal mining and reclamation operations of the COVOL Engineered Fuels, LLC Wellington Dry Coal Cleaning Facility have been designed to prevent material damage to the hydrologic balance outside the permit area.
VI. REFERENCES


Savage Coal Terminal

Price River Drainage CIA

Figure 2 - Cumulative Impact Area (CIA)

COVOL
COVOL

C0070045
Carbon County, Utah
Figure 2 - Cumulative Impact Area (CIA)
Township 15 South Range 10 East

Permit Area
Proposed Mine Plan Modification (if shown)
Proposed State Permit Modification
Active Permit
In Reclamation
Released Final Bond Release